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THE EARTHQUAKE.

BY RICHARD A. PROCTOR.

THE earthquake of April 22 belonged to the eastern series of British, or rather of English, earthquakes. There are two regions in which the most remarkable English earthquakes have occurred, one in the west, apparently having Herefordshire for its centre (or perhaps related more directly to the Severn Valley), the other affecting chiefly the eastern counties, though perhaps the eastern earthquakes may in turn be sub-divisible into those affecting the Thames Valley and those affecting the region drained by the Ouse. In KNOWLEDGE for Oct. 20, 1882, Nov. 3, Nov. 17, and Dec. 1, a somewhat full account of the most remarkable British earthquakes was given; and I refer readers to those numbers for full details.

It is noteworthy that the older earthquakes are described,—it may be, carelessly—as affecting the whole of England. Thus Wendover states that in 974 all England was shaken by an earthquake, while a chronicler writes of the earthquake of 1081 that its heavy bellowing was heard throughout the length and breadth of the land. We have no such earthquakes now. So in 1089 there was a "mickle earthquake over all England."

But the earthquake of 1110 was a western one, being felt most near Shrewsbury. That of 1165 was as markedly eastern: it was felt in Ely, Norfolk, and Suffolk, throwing men off their feet and ringing church-bells. So was the earthquake of 1185, in which Lincoln Cathedral was partially destroyed.

In the earthquake of 1247 the banks of the Thames were much shaken, many buildings being flung to the ground. But in 1248 the western parts of England were disturbed in their turn, the shocks experienced in Monmouthshire, Gloucestershire, and Somersetshire proving very destructive. So also the earthquake of 1275 was felt chiefly in the west.

The great earthquake of 1382 resembled in character that of April 22, but was more violent. Several churches in the south-east of England were thrown down.

The earthquake in which Lisbon was destroyed shook the whole of Great Britain, but can hardly be called a British earthquake.

For a long time after the earthquake of 1382 the only remarkable disturbances of the earth's surface in Great Britain were felt in Scotland. The neighbourhood of Comrie, in Perthshire, seems to have been a special region of disturbance,—in fact, scarcely a year passes without some signs of disturbance in or near Comrie.

The earthquake which took place in the autumn of 1863 was a western one, the region of most violent action being in the neighbourhood of Ross and Abergavenny. The Golden Valley in Herefordshire, and the beds of the Wye and its tributaries, were violently shaken.

The earthquake of 1868, which was a very slight affair, was also a western one.

The recent earthquake was a more serious matter. The shock was of different degrees of violence in different places, even in the central region of disturbance; but where the effects were strongest they approached in violence those disturbances in which buildings of considerable size have been cast down. It might be useful to collect the evidence of all who felt the shock distinctly, and by mapping down the spots where the disturbance was greatest, to determine the relation (if any is recognisable) between the structure and contour of the land, and the movements of greater or less energy in the earth's surface.

THE CHEMISTRY OF COOKERY.

XXXIII.

BY W. MATTIEU WILLIAMS.

THE practical importance of the fermentation described in my last is strikingly shown by the fact that, in the course of sponge rising, dough rising, and baking, a loaf becomes about four times as large as the original mixture of flour, water, &c., of which it was made; or, otherwise stated, an ordinary loaf is made up of one part of solid bread to more than three parts of air bubbles or pores. French rolls, and some other kinds of fancy bread are still more gaseous.

So far I have only named the flour, water, salt, and yeast. These, with a little sugar or milk added according to taste and custom, are the ingredients of home-made bread, but "baker's bread" is commonly, though not necessarily, somewhat more complex. There is the material technically known as "fruit," and another which bears the equivocal name of "stuff," or "rocky." The fruit are potatoes. The quantity of these prescribed in Knight's "Guide to Trade" is one peck to the sack of flour. This proportion is so small (about 3 per cent. by weight) that, if not exceeded, it cannot be regarded as a fraudulent adulteration, for the additional cost involved in the boiling, skinning, and general preparing of the small addition exceeds the saving in the price of raw material. The fruit, therefore, is not added merely because it is cheaper than flour, as many people suppose.

The instructions concerning its use given in the work above named clearly indicate that the potato flour is used to assist fermentation. These instructions prescribe that the peck of potatoes shall be boiled in their skins, mashed in the "seasoning tub," then mixed with two or three quarts of water, the same quantity of patent yeast, and three or four pounds of flour. The mixture is left to stand for six or twelve hours, when it will have become what is called a *ferment*. After straining through a sieve, to separate the skins of the fruit, it is mixed with the sack of flour, water, &c.

It is evident from this that it would not pay to add such a quantity in such a manner as a mere adulterant. The

baker uses it for improving the bread, from his point of view.

The *stuff* or *rocky* consists, according to Tomlinson, of 1 part of alum to 3 parts of common salt. The same authority tells us that the bakers buy this at 2d. per packet, containing 1 lb. in each, and that they believe it to be ground alum. They buy it thus for immediate use, being subject to a heavy fine if they keep alum on the premises. The quantity of the mixture ordinarily used is 8 oz. to each sack of flour weighing 280 lb., so that the proportion of alum is but 2 oz. to 280 lb. As one sack of flour is (with water) made into 80 loaves weighing 4 lb. each, the quantity of alum in 1 lb. of bread amounts to $\frac{1}{160}$ of an oz.

The *rationale* of the action of this small quantity of alum is still a chemical puzzle. That it has an appreciable effect in improving the *appearance* of the bread is unquestionable, and it may actually improve the quality of bread made from inferior flour.

One of the baker's technical tests of quality is the manner in which the loaves of a batch separate from each other. That they should break evenly and present a somewhat silky rather than a lumpy fracture, is a matter of trade estimation. When the fracture is rough and lumpy, one loaf pulling away some of the just belongings of its neighbour, the feelings of the orthodox baker are much wounded. The alum is said to prevent this impropriety, while an excess of salt aggravates it.

It appears to be a fact that this small quantity of alum whitens the bread. In this, as in so many other cases of adulteration, there are two guilty parties—the buyer who demands impossible or unnatural appearances, and the manufacturer or vendor who supplies the foolish demand. The judging of bread by its whiteness is a mistake which has led to much mischief, against which the recent agitation for "whole meal" is, I think, an extreme reaction.

If the husk, which is demanded by the whole-meal agitators, were as digestible as the inner flour, they would unquestionably be right, but it is easy to show that it is not, and that in some cases the passage of the undigested particles may produce mischievous irritation in the intestinal canal. My own opinion on this subject (it still remains in the region of opinion rather than of science) is that a middle course is the right one, viz., that bread should be made of moderately dressed or "seconds" flour rather than over-dressed "firsts," or undressed "thirds," *i.e.*, unsifted whole-meal flour.

Such seconds flour does not fairly produce white bread, and consumers are unwise in demanding whiteness. In my household we make our own bread, but occasionally, when the demand exceeds ordinary supply, a loaf or two is bought from the baker. I find that, with corresponding or identical flour, the baker's bread is whiter than the home made, and correspondingly inferior. I may say, colourless in flavour, it lacks the characteristic of wheaten sweetness. There are, however, exceptions to this, as certain bakers are now doing a great business in supplying what they call "home-made" or "farm-house" bread. It is darker in colour than ordinary bread, but is sold nevertheless at a higher price, and I find that it has the flavour of the bread made in my own kitchen. When their customers become more intelligent, all the bakers will doubtless cease to incur the expense of buying packets of "stuff" or "rocky," or any other bleaching abomination.

Liebig asserts that in certain cases the use of lime-water improves the quality of bread. Tomlinson says that, "in the time of bad harvests, when the wheat is damaged, the flour may be considerably improved, without any injurious result whatever, by the addition of from 20 to 40 grains of carbonate of magnesia to every pound of flour." It is also stated that chalk has been used for the same purpose. These would all act in nearly the same manner by neutralising any acid that might already exist or be generated in the course of fermentation.

When gluten is kept in a moist state it slowly loses its soft, elastic, and insoluble condition; if kept in water for a few days, it gradually runs down into a turbid, slimy solution, which does not form dough when mixed with starch. The gluten of imperfectly ripened wheat, or of flour or wheat that has been badly kept in the midst of humid surroundings, appears to have fallen partially into this condition, the gluten being an actively hygroscopic substance.

Liebig's experiments show that flour in which the gluten has undergone this partial change may have its original qualities restored by mixing 100 parts of flour with 26 or 27 parts of saturated lime-water and a sufficiency of ordinary water to work it into dough. I suspect that the action of the alum is of a similar kind, though this does not satisfactorily account for the bleaching.

The action of sulphate of copper, which has been used in Belgium and other places for improving the appearance and sponginess of loaves, is still more mysterious than that of alum. Kuhlmann found that a single grain in a 4 lb. loaf produced a marked alteration in the appearance of the bread. Fortunately this adulteration, if perpetrated to a mischievous extent, may be easily detected by acidulating the crumb, and then moistening with a solution of ferrocyanide of potassium. The brown colour thus produced betrays the presence of copper. The detection of alum is difficult.

I should add that the ancient method of effecting the fermentation of bread, and which I understand is still employed to some extent in France, differs somewhat from the ordinary modern practice described in my last. When flour made into dough is kept for some time moderately warm, it undergoes spontaneous fermentation, formerly described as "panary fermentation," and supposed to be of a different nature from the fermentation which produces yeast.

Dough in this condition is called *leaven*, and when kneaded with fresh flour and water its fermentation is communicated to the whole lump; hence the ancient metaphor. In practice the leaven was obtained by setting aside some of the dough of a previous batch, and adding this when its fermentation reached its maximum activity. One reason why the modern method has superseded this appears to be that the leaven is liable to proceed onward beyond the first stage of fermentation, or that producing alcohol, and run into the acetous, or vinegar-forming fermentation, producing sour bread. Another reason may be that the potato mixture above described, which is but another kind of leaven, is more effectual and convenient.

Dr. Dauglish's method (patented in 1856, 1857, and 1858) is based on the fact that water under pressure absorbs and holds in solution a large quantity of carbonic acid gas, which escapes when the pressure is diminished, as in uncorking soda-water, &c. Dr. Dauglish places the flour in a strong, air-tight iron vessel, then forces water saturated with carbonic acid under high pressure into this; kneading knives mix the dough by their rotation. When the mixture is completed a trap at the lower part of the globular iron vessel is opened. The pressure of the confined carbonic acid above forces the dough through this in a cylindrical jet or flat ribbon as required, and this squirted cylinder or ribbon is fashioned by suitable cutters, &c., into loaves. The compressed gas expands, and the loaves are smartly baked before the expansive energy of the gas is exhausted.

The difference between new and stale bread is familiar enough, but the nature of the difference is by no means so commonly understood. It is generally supposed to be a simple result of mere drying. That this is not a true explanation may be easily proved by repeating the experiments of Boussingault, who placed a very stale loaf (six days old) in an oven for an hour, during which time it was, of course, being further dried; but, nevertheless, it came out as a new loaf. He found that during the six days, while becoming stale, it only lost 1 per cent. of its weight by drying, and that during the one hour in the oven it lost 3½ per cent. in becoming new, and apparently more moist. By using an air-tight case instead of an ordinary oven, he repeated the experiment several times in succession on the same piece of bread, making it alternately stale and new, each time.

For this experiment the oven should be but moderately heated—130 deg. to 150 deg. is sufficient. I am fond of hot rolls for breakfast, and frequently have them *à la Boussingault*, by treating stale bread crusts in this manner. My wife tells me that when the crusts have been long neglected, and are thin, the Boussingault hot rolls are improved by dipping the crust in water before putting it into the oven. This is not necessary in experimenting with a whole loaf or a thick piece of stale bread.

The crumb of bread, whether new or stale, contains about 45 per cent. of water. Miller says "the difference in properties between the two depends simply upon difference in molecular arrangement."

This "molecular arrangement" is the customary modern method of explaining a multitude of similar physical and chemical problems, or, as I would rather say, of evading them under the cover of a conventional phrase.

I am making a few experiments which promise to afford an explanation of the changes above described, without invoking the aid of any invisible atoms or molecules, or anything else beyond the reach of our simple senses, and will communicate the results in my next paper.

LIFE IN MARS.

By R. A. Proctor.

ALL that we have learned about Mars leads to the conclusion that it is well fitted to be the abode of life. We can trace, indeed, the progress of such changes as we may conceive that the inhabitants of Venus or of Mercury must recognise in the case of our own earth. The progress of summer and winter in the northern and southern halves of the planet, the effects due to the progress of the Martial day, from sunrise to sunset—nay, even hourly changes, corresponding to those which take place in our own skies, as clouds gather over our continents, or fall in rain, or are dissipated by solar heat: such signs as these that Mars is a world like ours can be recognised most clearly by all who care to study the planet with a telescope of adequate power.

As regards the atmosphere of Mars, by the way, the earliest telescopic observers fell into a somewhat strange mistake. For, noticing that stars seemed to disappear from view at some considerable distance from the planet, they assigned to the Martial atmosphere a depth of many hundreds of miles—I care not to say how many. More careful observation, however, showed that the phenomenon upon which so much stress had been laid was merely optical. Sir J. South and other observers, carefully studying the planet with telescopes of modern construction, have been able to prove abundantly that the atmosphere of Mars has no such abnormal extension as Cassini and others of the earlier telescopists had imagined.

The early observations made on the polar snows of Mars were more trustworthy. Maraldi found that at each of two points nearly opposite to each other on the globe of the planet, a white spot could be recognised, whose light, indeed, was so brilliant as to far outshine that emitted by the remainder of the disc. The idea that these white spots correspond in any way to the polar snows on our own earth does not seem to have occurred to Maraldi. Yet he made observations which were well calculated to suggest the idea, for he noticed that one of the spots had at a certain time diminished greatly in size. Instead, however, of ascribing this change to the progress of the Martial seasons, he was led to the strange conclusion that the white spot was undergoing a progress of continuous decrease, and he even announced the date when, as he supposed, it would finally disappear.

No such disappearance took place, however. When Sir W. Herschel began his series of observations upon Mars, more than half a century later, the spots were still there. The energy of our great astronomer did not suffer these striking features to remain long unexamined. Searching, as was his wont, after terrestrial analogies—or, at least, analogies depending on known facts—he was quickly led to associate the white spots with our arctic regions. It would follow, of course, that in the summer months of either Martial hemisphere, the snow-cap would be reduced in size, while in the winter it would attain its greatest dimensions. Sir W. Herschel found this to be the case, and he was able to show that the changes which Maraldi had interpreted as suggesting the eventual disappearance of one of the bright spots, were due to the progress of the Martial summer. Precisely as in our summer months, those who voyage across the Atlantic may sail in far higher latitudes than they could safely venture to traverse in winter, so in Mars the polar ice and snow is limited within a far narrower region in summer than in winter.

But after all (it may be urged), to suppose that these two bright spots are formed in reality of ice and snow is rather venturesome. Might we not imagine that some other material than water is concerned in the observed changes? What reason have we for inferring that the same elements that we are familiar with exist out yonder in space?

The answer to these questions,—or, rather, the answers, for we have to do with a whole series of facts, dovetailing in the most satisfactory manner into each other,—will be found full of interest.

We all know that Mars shines with a ruddy light. He is, indeed, far the ruddiest star in the heavens: Aldebaran and Antares are pale beside him. Now, in the telescope the surface of Mars does not appear wholly red. We have seen that at two opposite points his orb exhibits white spots. But, besides these regions, there are others which are not red. Dark spaces are seen, sometimes strangely complicated in figure, which present a well-marked tinge of greenish blue. Here, then, we have a feature which we should certainly expect to find if the polar spots are really snow-caps; for the existence of water in quantities sufficient to account for snow regions covering many thousand square miles of the surface of Mars would undoubtedly lead us to infer the existence of oceans, and these oceans might be expected to resemble our own oceans in their general tint. According to this view, the dark greenish-blue markings on Mars would come to be regarded as the Martial seas.

If this be the case, then I may note in passing that the seas of Mars cover a much smaller proportion of his surface than those of our own earth, the extent of our

seas being to that of our continents about the proportion of 11 to 4: in Mars the land and sea surfaces would seem to be nearly equal in extent. The seas in Mars are also very singularly shaped. They run into long inlets and straits; many are bottle- or flask-shaped—that is, we see a somewhat rounded inland sea connected with what must be called the main ocean by a narrow inlet; and further it would seem as though oceanic communication must be far more complete in Mars (notwithstanding the relative smallness of his ocean surface) than on our own earth. One could travel by sea between all parts of Mars, with very few exceptions, the long inlets and the flask-shaped seas breaking up his land surface much more completely than the actual extent of water would lead us to infer. It may be supposed that on the other hand land communication is far more complete in the case of Mars than in that of our own earth. This is, indeed, the case, insomuch that such Martialists as object to sea travelling (and we can scarcely suppose sea-sickness to be a phenomenon peculiar to our own earth) may very readily avoid it, and yet not be debarred from visiting any portion of their miniature world, save one or two extensive islands. Even these are separated by such narrow seas from the neighbouring continents, that we may regard it as fairly within the power of the Martial Brunels and Stephensons to bridge over the intervening straits, and so to enable the advocates of land-voyaging to visit those portions of their planet. This view is encouraged by the consideration that all engineering operations must be much more readily effected in Mars than on our own earth. The force of gravity is so small at the surface of Mars that a mass which on the earth weighs a pound, would weigh on Mars about six and a quarter ounces, so that in every way the work of the engineer, and of his ally the spadesman, would be lightened. A being shaped as men are, but fourteen feet high, would be as active as a man six feet high, and many times more powerful. On such a scale, then, might the Martial navvies be framed. But that is not all. The soil in which they would work would weigh very much less, mass for mass, than that in which our terrestrial spadesmen labour. So that, between the far greater powers of Martial beings, and the far greater lightness of the materials they would have to deal with in constructing roads, canals, bridges, or the like, we may very reasonably conclude that the progress of such labours would be very much more rapid, and their scale very much more important than in the case of our own earth.

But let us return to our oceans, remembering that at present we have not proved that the dark greenish-blue regions we have called oceans really consist of water.

It might seem hopeless to inquire whether this is the case. Unless the astronomer could visit Mars and sail upon the Martial seas, he could never learn—so at a first view one might fairly judge—whether the dark markings he chooses to call oceans are really so or not.

But he possesses an instrument which can answer even such a question as this. The spectroscope, the ally of the telescope—of small use in astronomical work without the latter, but able to tell us much which the most powerful telescope could never reveal—has been called in to solve this special problem. It cannot, indeed, directly answer our question. It cannot so analyse the light from the greenish markings as to tell us the nature of the material which emits or reflects to us that peculiarly tinted light. But the astronomer and physicist is capable of reasoning as to certain effects which must necessarily follow if the Planet of War have oceans and polar snow-caps, and which could not possibly appear if the markings we call oceans were not really so, nor the white spots at the Martial poles really snow-caps. Extensive seas in one part of the planet, and extensive snow regions in another, would imply, in a manner there could be no mistaking, that the vapour of water is raised in large quantities from the Martial oceans to be transferred by Martial winds to polar regions, there to fall in snow-showers. It is this aqueous vapour in the Martial atmosphere that the spectroscope can inform us about. Our spectroscopists know quite well what the vapour of water is capable of showing in the rainbow-tinted streak which is called the spectrum. When white light is caused to shine through a sufficient quantity of the vapour of water, the rainbow-tinted streak forming the spectrum of white light is seen to be crossed by certain dark lines, whose position and arrangement there is no mistaking. Now the light we get from Mars is reflected sunlight, but it is sunlight which has been subjected to more than reflection, since it has passed twice through the depths of the Martial atmosphere, first while passing to his surface, and secondly while leaving that surface on its voyage towards ourselves. If that double passage have carried it through the vapour of water, the spectroscope will certainly tell us of the fact.

Let us see how this problem was dealt with by our most skilful spectroscopist, Dr. Huggins, justly called the Herschel of the spectroscope. The following account is an epitome of his own narrative:—"On Feb. 14, 1868, he examined Mars with a spectroscope attached to his powerful eight-inch refractor. The rainbow-coloured streak was crossed, near the orange part, by groups of lines agreeing in position with those seen in the solar spectrum when the sun is low down and so shines through the vapour-laden lower strata of our atmosphere. To determine whether these lines belonged to the light from Mars or were caused by our own atmosphere, Dr. Huggins turned his spectroscope towards the moon, which was at the time nearer to the horizon than Mars, so that the lines belonging to our own atmosphere would be stronger in the moon's spectrum than in that of the planet. But the groups of lines referred to were not visible in the lunar spectrum. It remained clear, therefore, that they belonged to the atmosphere of Mars, and not to our own."

This observation removes all reasonable doubt as to the real character as well of the dark greenish-blue markings as of the white polar caps. We see that Mars certainly possesses seas resembling our own, and as certainly that he has his arctic regions, waxing and waning, as our own do, with the progress of the seasons. But in fact Dr. Huggins's observation proves much more than this. The aqueous vapour raised from the Martial seas can find its way to the Martial poles only along a certain course—that is, by traversing a Martial atmosphere. Mars certainly has an atmosphere, therefore, though whether the constitution of that atmosphere exactly resembles that of our own air is not so certainly known. On this point the spectroscope has given no positive information, yet it allows us to draw this negative inference—that, inasmuch as no new lines are seen in the spectrum of the planet, it would seem likely that no gases other than those existing in our own atmosphere are present in the atmosphere of Mars.

(To be continued.)

In the House of Commons on Tuesday week Mr. Fawcett stated that the number of telegraph messages sent last year was 32,732,000, being an increase over the previous year of 640,000, which again was an increase over the preceding year of 746,000.

COPYRIGHT IN LECTURES.

By H. GREENWOOD, M.A., BARRISTER-AT-LAW.

LECTURERS will hail with satisfaction the recent decision of Mr. Justice Kay, to the effect that they, and not their audiences, have the right of publishing their own lectures. A full and fair newspaper report of a lecture is an undoubted advantage to the lecturer; but the unauthorised publication and sale by a stranger of the entire lecture is quite another matter. It inflicts a treble injury upon the lecturer,—first, by diverting the profits which justly belong to him into the pockets of another; secondly, by enabling persons who might form future audiences to read the lecture instead of hearing it; and, thirdly, by rendering it impossible for him to publish his lecture for his own benefit at any future time. To a mind unversed in legal subtleties it might appear a self-evident proposition that a man has an exclusive right to the creations of his own brain and the results of his own study and research; but in the present state of the law of copyright it is not safe to take too much for granted.

That an author who has *published* and duly registered under the Copyright Acts his book or his pamphlet acquires the exclusive English copyright in it for a specified time is provided by law; and it is clear that the author of an unpublished manuscript may lock it up in his own desk, and thus keep it from publication during his pleasure. And although he may lend his manuscript to any number of friends for private perusal, he has the right to say that nobody shall publish it without his permission. But an impression seems to have been prevalent in some quarters that the delivery of a lecture is a sort of dedication to the public.

It is true that a venerable Lecture Copyright Act, passed half a century ago, provides for the recovery of certain penalties in case of the unauthorised publication of a lecture. But, in order to take advantage of this Act, it is necessary to give previous formal notice to two neighbouring justices of the peace of the intended delivery of the lecture; and as this is seldom, if ever, done, the Act is practically a dead letter, and the rights of the lecturer are governed by the law as it existed before the passing of the Act.

Where no such notice is given, it has often, though erroneously, been assumed that any person, capable of doing so, who hears a lecture, may not only take down in shorthand every word which falls from the lecturer's lips, but may either publish the notes so taken, or make any other use of them which he thinks fit.

It is probably in consequence of such misapprehension of the law that the well-known phonographic publisher, Mr. Pitman, has for some years been in the habit of taking notes of popular lectures, and publishing them in a monthly serial called the *Phonographic Lecturer*. Although this publication is in phonographic characters, it has a large circulation among readers and learners of shorthand; but the legality of this practice does not appear to have been questioned until the present year. The *Phonographic Lecturer* for February, 1884, contained a leeture entitled "The Dog as the Friend of Man," which had been delivered by Mr. Arthur Nicols, F.R.G.S., F.R.S., at the Working Men's College, in October, 1882. The publication was wholly unauthorised by him, and he brought an action to restrain Mr. Pitman from continuing the publication of the lecture, and to compel him to deliver up all copies of it in his possession. It appeared that admission to the lecture was gained by tickets, issued gratuitously by the Committee of the College; and it was contended on behalf of the defendant that, inasmuch as his ticket contained no intimation that the lecture was copyright, he was quite at liberty to publish it. Mr. Justice Kay, however, held that there was an implied contract between the lecturer and his audience to the effect that no person who heard the lecture should publish it for his own profit, and to the consequent detriment of the lecturer; and he granted the relief asked for, with costs. In so doing he followed a decision of Lord Eldon who, in 1823, granted an injunction to restrain the publication in the *Lancet* of lecture delivered by Dr. Abernethy to his pupils. It is worthy of observation that the question does not seem to have been raised in an English Court since that time, probably because Lord Eldon's decision has, to some extent, been misunderstood. Although he ultimately granted the injunction, he at first refused to do so, because Dr. Abernethy's lecture had not been reduced into writing, and he doubted whether ideas and sentiments orally delivered constituted a sufficiently tangible description of property to claim the protection of the Court. But his final judgment was based on the lecturer's right of property in his composition, as well as on the breach of an implied contract between the doctor and his pupils. In the recent case the lecture *had* been reduced into writing, but the judgment of Mr. Justice Kay was based on the same grounds as that of Lord Eldon, and will, therefore, also apply to cases where lectures are orally delivered without having been previously written.

No damages were given to the lecturer, because, although the publication in phonographic characters was just as much an infringement of his rights, as a publication in Greek, Latin, or Sanscrit would be, it was not a publication calculated to inflict so serious an injury upon him as a publication in ordinary typographical characters would have been.

The practical result of this decision will be, not to render illegal a fair newspaper report of any lecture, but to assure all lecturers that the law implies a contract between them and their audiences which will enable them to retain for their own benefit the sole right of publishing in a complete form, the lectures which are, in many cases, the result of years of observation, thought, study, and experience.

OPTICAL RECREATIONS.

By a FELLOW OF THE ROYAL ASTRONOMICAL SOCIETY.

"SEGNIUS irritant," wrote Horace to the Pisos 1,900 years ago, "Segnius irritant animos demissa per aurem, quam quæ sunt oculis subjecta fidelibus." Things which we merely hear with the ear affect the mind less than those which have been subjected to the more trustworthy sight. With reference to no department of human knowledge are these words truer than they are in connection with the study of physical science. The student may, and often does, succeed in mastering the principles of some physical phenomenon after hours and, perhaps, days of reading; but, still, his conception of it is not of a vivid character, and he fails to realise it, in any legitimate sense, thoroughly. Let him, however, make it the subject of experiment, let him witness it with his own eyes, and the whole character of his knowledge of it is at once changed. The reader may forget: the observer never does.

The study of the properties of, and the phenomena exhibited by, light, and of its effects upon our own organs of vision is an extremely interesting one, and may be carried on by the aid of the most inexpensive apparatus. Especially do such properties and phenomena admit of illustration by curious and amusing toys, a description of some of which

will form a leading feature in this series of papers. In them we purpose to give a theoretical and descriptive account of the phenomena of light and vision, and to explain the construction of the very simple apparatus by the aid of which the student may see and observe such phenomena for himself. In every case we shall give practical instructions for the manufacture of the apparatus described; so that the reader possessed of the slightest mechanical aptitude may be able to make it with his own hands. If, occasionally, some of the instruments we treat of may appear at first sight of a trivial and childish character, we would, in the outset, plead that it by no means follows that the lessons to be derived from them will possess less scientific value. The immortal Newton himself excited ridicule by blowing soap-bubbles, but his optical discoveries made by their aid are now matter of history, and have largely contributed towards our knowledge of the nature of coloured light.

To begin with, then; the fact that we see at all shows that there must be a communication of some sort between the eye and the object viewed. Plato and Empedocles, among other of the ancient philosophers, regarded sight as a species of touch, and imagined that something went out from the eye to the object seen! How any one got this strange idea into his head it would be hard to guess. Perhaps the originator of it had been viewing a lamp with his eyes nearly closed, and took the rays seemingly connecting his eyes and the lamp for some kind of feelers proceeding from his own visual organs. But we give this notion, which occurs to us as we write, for what it is worth. The fact, however, that we cannot see in the dark is sufficient to show that vision is not a tactile sense in the way these old philosophers conceived it to be, and that something else besides the eye is concerned in it. For every one knows that unless an object is what we call "luminous," either inherently so, like the sun, the fixed stars, a lamp, or the electric arc; or from reflected light, like the moon and planets, the walls of our rooms in the daytime, or by lamp-light, or the page on which the reader's eyes are now fixed, it is invisible. Moreover, it is further essential that nothing opaque shall intervene in a straight line between the eye and the object viewed. The fore-finger, if held sufficiently near to either eye (the other being closed), will blot out all view of this page whatsoever. Calling, then, the medium between the object seen and the eye light, we may say that it is only perceived when it enters the eye in straight lines. Whatever its nature may be (a question to be immediately discussed), one thing is quite certain, and that is that *light is itself invisible!* Let us begin our experimental investigations by showing this.

A tube should be made (by rolling pasted brown paper round a wooden cylinder) and lined with the dead black paper procurable at most stationers' shops. The bottom of this is closed, but one end is left open to be looked into. Two large holes, which are shown at H H' in figure 1, one on each side, make a wide opening to admit strong light across the tube only. A smaller hole, *h*, is also bored,

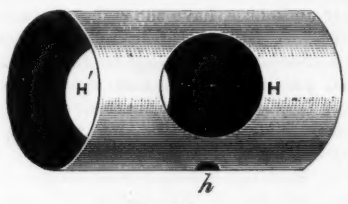


Fig. 1.

for the purpose to be immediately explained. Now, let the sunlight entering, say, through a hole in the shutter of a darkened room, shine through the side apertures of our tube, going in at one and coming out at the other, and let us look into the tube. Doing so, we shall see—nothing. Everything is perfectly dark. If now, though, through the little hole, *h*, we introduce the tip of a tooth-brush handle, or of the finger, or a bit of white paper into the course of the rays, this instantly reflects a portion of such rays of the crossing beam of light, and so reveals their existence. We have described this little piece of apparatus, because it exhibits the fact it is intended to illustrate in a vivid form—a moment's consideration, though, will show that were light, as light, not invisible, the whole of our night-sky, outside of the conical shadow of the earth, must be a blaze of light, as, of course, the sun's rays are traversing it everywhere. But here, the observant beginner may remark:—"If what you say is true, how do you account for those fan-like rays seemingly emanating from the sun, which country people call 'the sun drawing water'; why is it that you can often track the beam of light from a police man's bull's-eye lantern, like a comet's tail; and how was it that the last time I was in a room with the shutters shut and the sun shining through a chink in them, I could trace the light right across from the shutter to where it fell on to the floor?" The answer to which very pertinent questions is, that in the first two cases particles of vapour, and in the third case of dust, played the part of our tooth-brush handle, or bit of paper, and reflected to our eyes some of the crossing light. A pretty illustration that light travels in straight lines may be obtained thus.

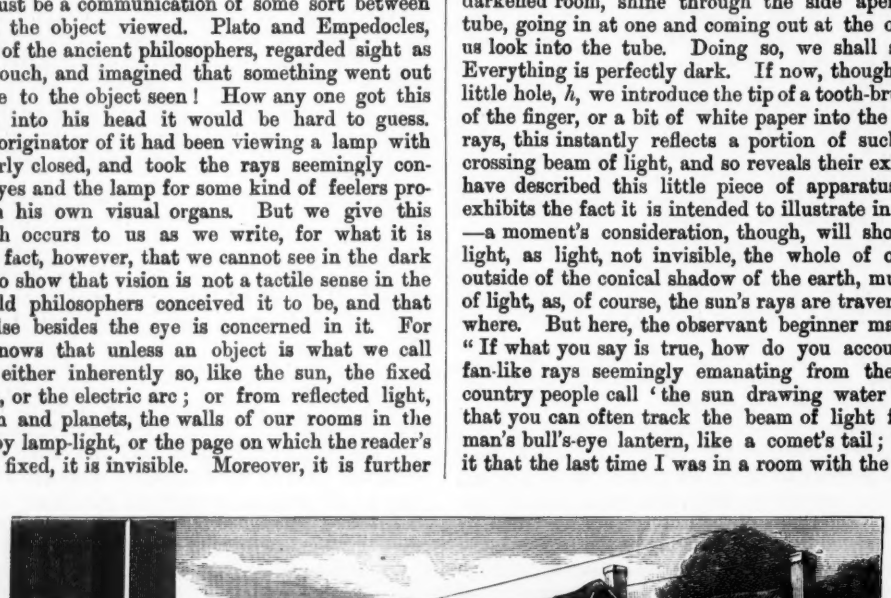


Fig. 2.

Darken a room, looking out upon a street or landscape, totally, and bore a little gimlet-hole in the shutter. Now hold a white screen in front of the hole, shifting it backwards and forwards until the image painted upon it is at its sharpest; then will the whole exterior view be seen depicted

on the screen in its natural colours, but turned upside down, on account of the rays of light crossing in the opening. The course of the rays is shown in Fig. 2. So far, then, we have learned two things concerning the means of communication between our eyes and the objects we see: the first, that it is itself invisible; and the next, that it is propagated in straight lines. Let us see what else we can discover as to its nature. Every means of physical communication (save perhaps gravitation) takes time. If we wish to get from Westminster Bridge to Kew Gardens, we shall scarcely effect it by two hours' walking. The Underground Railway, however, will take us there in about five-and-thirty minutes; while the flight of a Whitworth projectile would be measured by seconds. Still, whether the interval be short or long, an interval there is, as we have said, in every means of physical communication. Now, does this exist in the case of light? Our first impulse would be to say, No. The velocity with which light travels is so enormous, that, save by apparatus of the utmost possible refinement and delicacy, it is absolutely immeasurable upon the earth. Galileo was the first to attempt to ascertain the rate at which it travels. In effect his method was this: he placed two observers a mile or two apart at night, each having a lantern, with a little contrivance by the aid of which the light could be instantaneously covered and caused to disappear. Then Observer No. 1 covered his lantern, and as soon as Observer No. 2 saw the distant light disappear he covered his also. Now that the first observer should see the light of the second disappear it will be noted that the light must have travelled from the first station to the second and back again. Suppose, for the sake of illustration, that the stations were two miles apart, and that the light travelled two miles in a second, then Observer No. 2 would continue to see the light of Observer No. 1 for a second after it had actually been extinguished; and if he then instantly shut off his light, Observer No. 1 would continue to see that for a second after it had gone out; so that, apparently, to him light No. 2 would not disappear for two seconds after he had extinguished his own. But this ingenious device of the immortal Pisan broke down utterly; as we know now, because so far from light travelling two miles in a second, it traverses that space in ·000011 second; or, practically, in just one hundred thousandth part of the time!

It was through the eclipses of Jupiter's first satellite (p. 126) that our first inkling of the velocity of light was obtained. In 1675, Römer, a Danish astronomer living in Paris, set himself to improve the tables of these phenomena. He found that this satellite went round the planet in 42h. 28m. 36s., so that if it were eclipsed at a given instant, its (say) forty-seventh succeeding eclipse would be accurately predicted by adding 42h. 28m. 36s. × 47 to the observed time. His first observations were made when the earth was at her nearest point to Jupiter—when she was between him and the sun, or, technically speaking, Jupiter was in opposition. Six months afterwards, when the earth was on the opposite side of the sun, or Jupiter was approaching conjunction, Römer found, to his surprise, that the eclipses happened (as he supposed) 22m. too late! By a flash of inspiration, it occurred to him that this must arise from the light taking this time to cross the diameter of the orbit of the earth; so that light must travel from the sun to the earth (over the radius of that orbit) in about 11m. There was considerable error in this determination, owing to Römer's imperfect means of observation, but the principle was correct enough; 8m. 19s. represent this last time with greater accuracy. The theory of the ingenious Dane was subsequently corroborated by the discovery of Aberration in 1728 by Bradley, who showed that, owing to the velocity of the earth's motion in her orbit bearing a measurable proportion to that of light—being, in fact, 1-10,089th the latter—every star apparently describes a tiny annual orbit at right angles to that of the earth. Bradley, though, as well as Römer, over-estimated the velocity of light, from imagining the earth to be farther off from the sun than we now know it to be.

(To be continued.)

ELECTRO-PLATING.

IV.

By W. Slingo.

SEVERAL forms of battery are employed by working electroplaters, some of which can lay claim to but few if any good qualities. The forms most generally used are the Daniell, Smee, or a modification of the simple cell containing copper and zinc plates immersed in an acid solution. The first great desideratum in electro deposition is a current of constant strength derived from a source of low resistance. Now, of all the cells ever introduced, there never has been, and it is open to doubt if there ever will be, a battery steadier or more reliable than the Daniell. The relative resistance of a Daniell cell is high, but this is a difficulty which may always be overcome by increasing the dimensions of the plates. It is urged by those opposed to this battery that it is a troublesome one, and calls for a great deal of attention. But it is a remarkable fact that in other industries, where battery cells are used by the thousand, the Daniell cell requires less attention than almost any other form of battery. The chief point to be observed in the maintenance of the battery is to keep it clean, internally as well as externally. A damp cloth should be passed over the top of the porous pot, &c., to remove any crystals that may have been deposited, and the zinc plate should be freed from any copper which may have been deposited upon it. Occasionally a portion of the zinc solution should be removed and the cell filled up with water. The copper division should always contain a supply of undissolved sulphate. With a battery of two cells a mean attention of ten minutes every other week should keep it in excellent order, and it is not too much to say that the current yielded ought not to vary in strength to the extent of 1 per cent. The amateur will find two cells of gallon capacity answer his purpose for depositing copper. The zinc may take the form of a cylinder (of quarter inch metal) or of a rod, being placed in the former case outside the porous pot, and in the latter case inside the pot. If the amount of zinc surface in the one instance be equal to the amount of copper surface in the other, and the copper surface of the first equal to the zinc surface of the other, equal currents will be produced, because the resistances are identical. An easily-cast zinc rod may therefore be made to yield a current equal in strength to that resulting from a large cylinder. The weight of zinc consumed for equal currents must, obviously, be equal. The rod would consequently call for more frequent renewal than the cylinder. I am in the habit of using zinc cylinders made from quarter-inch plates weighing 10 lb. each. No advantage is gained by using an outer vessel made entirely of copper as the negative plate. Smaller cells may be used, but the quantity of copper deposited will be proportionately less. When the battery is not in use, it will be found to be advantageous to remove the zinc from the solution. A small piece of zinc placed at the bottom of the zinc division also helps to keep the solution clear by precipitating the metal from any of

the copper solution that passes through the porous partition. When the battery is not expected to be called upon for any lengthened period, the porous pot should likewise be removed and placed in a vessel containing water.

A very useful and economical form of battery is a modification of the Smee, in which odd scraps of zinc are placed at the bottom of a glazed earthenware jar, and pouring over them a few ounces of mercury (sufficient at least to connect all the zinc scraps). This forms the positive plate, the bared end of a piece of gutta-percha-covered wire dipping into the mercury to provide a means of connection. The negative plate consists of a thin sheet of platinised silver. Acidulated water (one of sulphuric acid to twelve of water) is poured in until the silver plate is covered. Such a cell offers but little resistance, and is reliable. As the zinc is dissolved, fresh scraps should be placed in the mercury.

Sufficient having been said anent the battery and the required current, it behoves us to direct our attention to the electrolytic cell, or the vessel in which the deposition is intended to be produced. The various depositions of copper may be divided into three classes: the separation of pure copper from the crude metal; the development of a copper surface on baser metals; and the production of copies of an innumerable variety of substances. The separation of pure metal is an important process to the practical electrician, as the copper may be obtained from the impure smelted metal in a state of almost absolute purity. As the demand for electrical wires of the highest conductivity increases, there is little doubt but that this industry will be largely developed. The process consists in immersing the slab of crude metal in a solution of sulphate of copper, and connecting it to the positive pole of a battery or, in this particular case, of a dynamo machine specially wound so as to yield a current of great strength (in amperes) but of feeble electromotive force. If the containing vessel be of metal, or if it is covered internally with some conducting material such as plumbago, it may be connected to the negative pole of the generator of the current. The flow of electricity results in the slab being dissolved and the copper precipitated either on the sides of the vessel or on whatever else is used as the negative electrode. It is an interesting fact that, however many impurities may be present in the slab, very few are likely to be deposited with the copper. The most likely is cadmium, and that is rarely present. The impurities, naturally, vary with different examples of crude metal. According to Dr. Gore, "silver is precipitated at the anode or positive electrode by the traces of hydrochloric acid present in the common sulphuric acid employed. Gold falls as metal at the anode, lead as sulphate; carbon and metallic sulphides, also selenium and silica fall at the anode. Zinc, iron, tin, cadmium, cobalt, nickel, and antimony are more or less dissolved, but, being less readily deposited than copper, remain in solution. Arsenic falls as an arsenide." By a similar process copper is frequently separated from the rough ore.

"Electro-plating" is a term generally applied to the deposition of silver upon baser metals and other substances which require a silver coating; but it is equally applicable to the like deposition of any other metal. The process consists in placing the substance to be coated in the electrolytic cell, and connecting it to the negative pole of the battery. When depositing copper a bluestone solution is employed, and the anode or positive electrode consists of a stout plate of good copper. The passage of a current causes the decomposition of the solution and the deposition of the metal. The acid portion of the decomposed sulphate of copper dissolves copper from the plate forming the anode equal in quantity to that deposited, so that the amount of sulphate in solution remains constant. Although but few metals are deposited in the presence of copper, it is essential in plating processes to use copper-plates and salts of the purest obtainable qualities, otherwise the solution will soon become charged with a large percentage of impurities.

The third form of electro deposition, viz., electrotyping, or the production of metallic copies of various substances, consists in placing a mould or cast of the object to be copied in an electrolytic cell or bath, the surface of the mould being well covered with some such substance as plumbago, and connected with the negative pole of a battery. The other conditions of the cell are similar to those of the plating process. The preparation of iron and other metallic surfaces, and the manufacture of moulds, &c., involve processes fraught with the greatest interest, and will next claim our attention.

HOW TO SELECT A LIFE ASSURANCE OFFICE.

II.

IN making comparisons between the affairs of various life assurance offices there are two or three facts that should be borne in mind.

1. Is the rate of interest on the assets too great or too small? If it be above the average rate of interest, it would show that the investments are risky; and, as there are fewer purchasers for risky investments, and such investments often decline in price and require time in order to be realised without loss, that therefore they are probably not readily realisable. In such case, there may be delay, or possibly failure in paying the death claims in full. If the rate be below the average, it would seem that the funds are not invested to the greatest advantage, and that the bonus returns would accordingly be small.

2. With regard to the items of commission and expenses of management, it is a matter of great judgment and requiring large experience. What is the boundary-line between wasteful expenditure and ill-advised parsimony? As either extravagance or parsimony will prejudice the assured, the former reducing the bonus, and the latter affecting the size and prosperity of the office, it is important to ascertain what is that boundary line, and assuredly it will be best known by those who have had experience, namely, the directors of the best offices. Their opinion will be evinced by the average amount they spend in these items, which amount has been already ascertained.

3. It has been said that, under certain circumstances, excessive premiums do not at all prejudicially affect the assured in mutual offices, and only to a certain extent the assured in offices having proprietors. The subject may be carried further. The amount of each premium being small, it will generally be paid out of income, and not out of capital, and if it were not so applied it would most probably be expended on unnecessary purchases, or be lying idle in a bank. But an assurance office aggregates the several premiums they receive, and reserving as much ready money as experience proves necessary to meet current liabilities, invest the residue at compound interest. The excessive premium being thus returned with the interest to the assured as "bonus," he gains an obvious benefit.

4. It is found that an office begins to feel the strain of first assurers dying and first death-claims occurring when it has been established about thirty years. It is therefore well to select an office that has successfully tided over this important era, and has not then been found wanting.

5. No doubt, on principle, the assured in an established, well-managed office paying adequate premiums, do not require the security of a proprietors' fund to be certain that the office will meet its liabilities. The amount the proprietors take out of the profits above the amount of the current rate of interest on their capital is, therefore, loss to the assured.

6. With regard to the size of an office. Fifty men of the same age might form amongst themselves an assurance society; but the working of such a society would not be as economical as that of a large society. First, the expenses that would be necessary for working a society of fifty members would be sufficient, or nearly sufficient, for working another of 100 members. Consequently each member of the smaller society would have to pay twice as much towards working expenses as the member of the larger society; and the premiums of the smaller society would have to be larger in proportion. Secondly, the large society would be justified in giving a remuneration sufficient to attract persons of acquirements and cultivated intelligence superior to the common average, and who have made the management of assurance societies their specialty, to fill the appointments of a skilled character; and these persons, from their superior education and greater experience, would be able to see probabilities of advantages, to guard against blunders, and generally to conduct the business of the society to the best advantage. But a small society would be reluctant, on the ground of expense, to employ highly-paid officials. Thirdly, if the number of members, or the area of their residence, or the variety of their occupations, be limited, there is a greater liability to more than average mortality, by reason of the number of members not being sufficient to allow the number of deaths at old ages to counteract the number at young ages; or of there being an epidemic, and consequent exceptional mortality, in the area; or of all the occupations of the members being unhealthy. The small society may therefore either require to ask higher rates of premium, or fail to meet its liabilities. On the other hand, in a large society, the members would be numerous, and scattered over a large area. An epidemic at one place, or the fact of some members being engaged in one of the more unhealthy occupations, would be compensated for by unusual healthiness in another place, or by other members being more healthily engaged. Besides which, the funds of a large society would be able to tide over any exceptional strain, while those of a smaller society would not.

7. Public opinion, as evidenced by the popularity of an office, is surely worth attention, as showing the justice and liberality with which the office is accustomed to treat the assured.

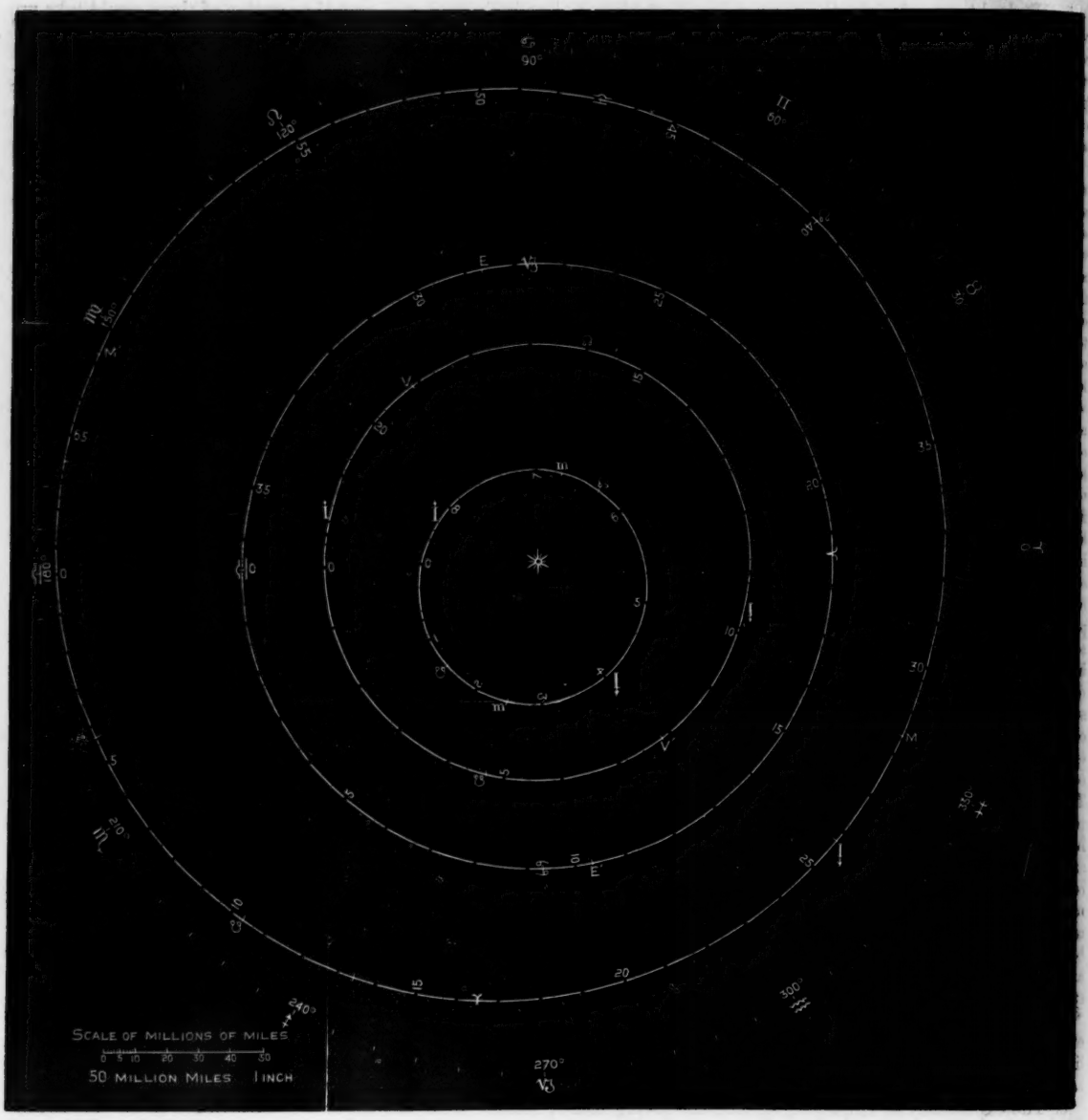
8. The expediency of employing agents, and giving commissions, more especially the latter, is a matter on which opinions differ. Some will say that in these days of keen competition, the practice is necessary, and the money so spent an economical outlay—the giving of commissions being a fair way of remunerating those who use their influence to bring business. Others will tell you that, even if agents be necessary, the granting of commissions is bribery and corruption.

In conclusion, a young clerk, or man in receipt of a salary which will probably increase, would be glad if he might pay a smaller premium for the first few years. On the other hand, a newly-married woman would be glad to pay more at first, so that when her sons and daughters grow up, and become more expensive, she may have the more money at disposal with which to help to educate them, and start them in life. Some of the offices are willing to accommodate their customers in these and in many other minor matters; but these matters apply only to individual cases, and the mention of them would take up too much of our space. Assistance must, if necessary, be obtained from those who are acquainted with the course of business of the various offices, and have the requirements of the particular case before them.

SINCE 1879 the mileage of Ohio railways has increased 107 per cent., the number of locomotives 145 per cent., and the number of cars 456 per cent. The number of cars to each locomotive in 1869 was 15; now the number is 34. Improvements in permanent way by the laying of steel rails, substantial ballast, and superior motive power have increased the carrying capacity of Ohio railways 126 per cent. during the last fifteen years.

AN ELECTRIC TRAMWAY INCIDENT.—The following appeared recently in the *Irish Times* (Dublin):—"It is not generally known that the country people along the line of the electric railway make strange uses of the insulated rails, which is the medium of the electricity on this tramway, in connection with one of which an extraordinary and very remarkable occurrence is reported. People have no objection to touch the rail and receive a smart shock, which is, however, harmless, at least so far. On Thursday evening a ploughman, returning from work, stood upon this rail in order to mount his horse. The rail is elevated on insulators 18 in. above the level of the tramway. As soon as the man placed his hands on the back of the animal it received a shock, which at once brought it down, and falling against the rail it died instantly. The remarkable part is, that the current of electricity which proved fatal to the brute must have passed through the body of the man and proved harmless to him."

ONE of the finest examples of lighthouse construction the world possesses, says the *Electrical World*, is that at the entrance to Port Jackson, Australia, called Macquarie Light. It is a first order, 16-sided, dioptric, holophotal revolving white light, of the system of Fresnel, showing a flash of eight seconds in every minute, and having a range of 25 miles seaward. The gas and oil burners for use during clear weather have, with flames of 1½ in. diameter, an intensity of about 200 candles instead of 80 candles with the same diameter, as with the old type of burner originally intended. When these flames are at the focus there is a consumption of about 40 cubic feet per hour of 16-candle gas, and of good paraffin about 1 pint per hour, and it is estimated that the mean intensity of the flashes from the apparatus is about 40,000 candles, or about five times the intensity of the flashes of the old Macquarie Light. With the full power of the electric light (used in conjunction with the gas in hazy weather) at the focus, the mean intensity of the flashes in the direction of the sea horizon is not less than five or six million candles. By a single arrangement the change from gas light to electric light at the focus or the reverse, can be effected in ten seconds, and the flames of the oil lamp can be substituted for the gas or electric light in nearly the same space of time. The Macquarie Light is intended only to illumine half the horizon. It is therefore possible to make use of the landward rays by means of a dioptric mirror. This is probably the first instance of the use of a dioptric mirror for an electric light. Arrangements are made to burn either gas or paraffin oil, or to exhibit the electric light at full power or half power. When the electric light is in use, there is always a second lamp in readiness for action.



PATHS OF MARS (M), EARTH (E), VENUS (V), AND MERCURY (m).

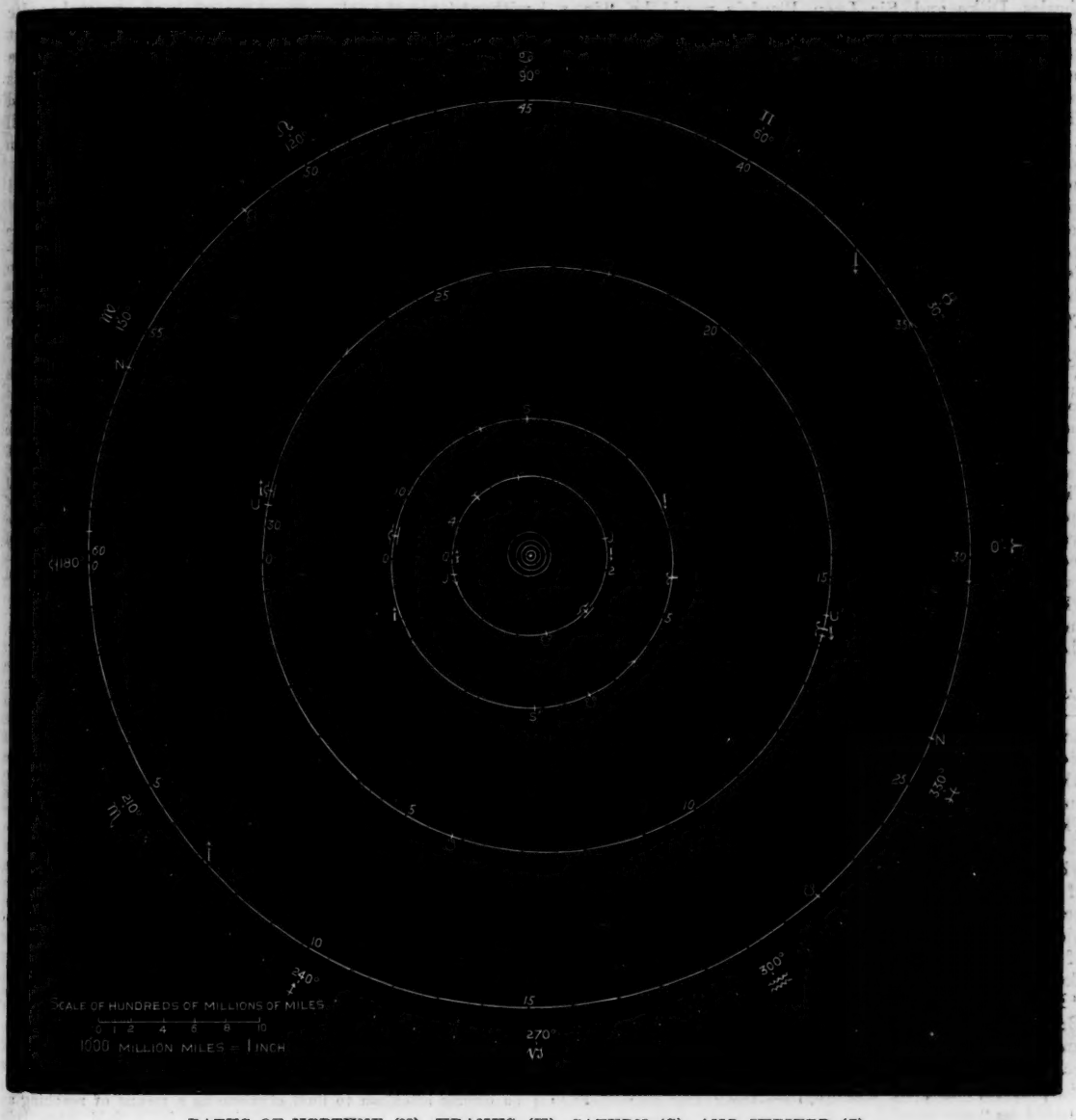
Fig. 1.—The central part of the solar system, showing the region where the terrestrial planets travel. The scale of Fig. 1 is twenty times that of Fig. 2. The numbers round the orbits indicate the number of ten-day periods occupied by each planet in passing to the position so numbered from the position numbered 0 on its orbit.

PLANETARY MOVEMENTS.

SEVERAL correspondents have expressed a wish that we should show from time to time (some suggest once a month) the position of the planets in their respective paths around the earth. Perhaps the accompanying diagrams, which *together* serve to show the real proportions of the solar system, may indicate the difficulty of the suggested task. The pictures explain themselves. The *perihelion* of each planet is where the planet's initial letter (N for Neptune, U for Uranus, and so on, M for Mars, and m for Mercury) is put unaccented; *aphelion* where the initial letter is accented. Rising nodes are marked ☊, descending nodes ☋. The greatest distances attained above and below the plane of the earth's path are shown by a mark like the letter I with a little arrow above or below, respectively. The place corresponding to the spring of the northern hemisphere of each planet whose axial position is known is marked ♈, the place corresponding to autumn is marked ♎.

The puzzle is how *usefully* to show the monthly positions of the various planets.

[Readers are requested to obliterate the marks ♀ and ♁ on the earth's path in Fig. 1.]



PATHS OF NEPTUNE (N), URANUS (U), SATURN (S), AND JUPITER (J).

Fig. 2.—The solar system, showing (truly to scale) the paths of the eight primary planets, and the position of the zone of asteroids. The scale of Fig. 2 is one-twentieth that of Fig. 1. The numbers round the orbits indicate the number of 100-day periods occupied by each planet in passing to the position so numbered from the position numbered 0 on its orbit.

Reviews.

SOME BOOKS ON OUR TABLE.

Lives Worth Living. I. Sir John Herschel. By the REV. TIMOTHY HARLEY, F.R.A.S. (London: Alexander & Shepheard, 1884.)—Here, again, is a little tract containing much that is interesting and readable, but disfigured by the "goody" element, which is dragged in, in season and out of season. The perusal of such a work as this always suggests to us the reasonableness of the negro in the legend, who protested against being compelled to endure the "preachee, preachee," in addition to the "floggee floggee." The reader, though, may if he chooses, skip the bits of sermons scattered through Mr. Harley's biography of the great astronomer; he will find the rest pleasing and instructive enough.

Sir Lyon Playfair Taken to Pieces; Likewise Sir Charles Dilke, Bart. (London: E. W. ALLEN, 1884.)—Lest anyone hastily reading the above title should be frightened into the temporary belief that two eminent statesmen have been dissected and their remains got rid of, let us hasten to reassure them by saying at once that the farrago whose title heads this notice is the production of one of those amiable fanatics the anti-vaccinators. If assertion were proof, or abuse and declamation argument, verily Sir

Charles Dilke and Sir Lyon Playfair would be "in a parlous state." Inasmuch, however, as ninety-nine per cent. of the readers of Mr. White's book will at once decline to accept them as such, we may reasonably regard the two objects of its attack as still entire and unscathed. The senseless insult to an eminent American physician, on p. 49; the utterly unsupported assertion as to the domestic surroundings of Mary, the Queen of William III., on p. 110; and the vulgarly abusive letter on p. 127 *et seq.* will suffice to disgust many who will perhaps fail to perceive the fallacies underlying the mass of Mr. White's statistics. It may—or may not—be desirable that vaccination should be compulsory, but it is absolutely certain that the repeal of the existing law will never be brought about by such stuff as this.

Facts Around Us.—Simple Readings in Inorganic Science, with Experiments. By C. Lloyd Morgan, F.G.S. (London: Edward Stanford. 1884.)—This little book contains a series of lessons in Physics, adapted to the capacity of the young; and is apparently intended to be used as a text-book by the teacher, who is to illustrate the various essays by the simple experiments described in them. There are forty of these lecturettes in the work before us; an appendix of chemical problems, with answers; and a really good index. We have said that Mr. Morgan's book seems to pre-suppose its use by a teacher; but it appears to us equally adapted for self-instruction, Certainly, any one who will thoroughly master its contents will have received an efficient grounding in the rudiments of natural and chemical philosophy.

Physiography. Advanced Course. By Andrew Findlater, M.A., LL.D. (London: W. & R. Chambers. 1883.)—We have one solitary fault to find with Dr. Findlater's work, and that is its title. This is one of those pieces of bastard classicism (akin to "chromosphere") for which we are indebted to certain gentlemen at Brompton, and was well described at the time of its introduction as Physi(cal ge)ography eviscerated. The present work deals, though, mainly with Celestial Physics and Chemistry, subjects which are treated at once succinctly and efficiently; a mass of astronomical information being at once pleasantly and perspicuously conveyed. We note that while the author himself, of course, speaks in pp. 25 *et seq.* of the Precession of the Equinoxes," in a copy of the "Syllabus of the Science Department, South Kensington," on p. 152, the "Procession of the Equinoxes" appears. Does the Brompton Examiner in "Physiography" regard the annual motion of the intersection of the equator and the ecliptic as a species of celestial Lord Mayor's Show? "Aperture," too, by the way, on the ninth line of p. 3, should be "aperture^2."

The Art of Soap-Making. By Alexander Watt. (London: Crosby, Lockwood, & Co. 1884.)—If the time-worn proverb be true that "Cleanliness is next to godliness," then should the English nation (as assuredly the very "tubbingest" in the world) be on the high road to righteousness, and Mr. Watts's capital book command a circle of readers co-extensive with the British public. Speaking seriously, however, this is really an excellent example of a technical manual, entering, as it does thoroughly and exhaustively, both into the theory and practice of soap-manufacture. Not only will Mr. Watts's book, we imagine, be read by every one engaged in the soap trade, whether as producer or distributor; but its pages may be consulted, not without profit, by all who wish to get a little behind the scenes as to the composition of those "toilet soaps," &c., whose virtues are extolled in advertisements of such remarkable ingenuity. Nor will certain trade "dodges" for cheapening the production of soap be without interest to the consumer; while the general reader may here learn how glycerine is recovered from the spent "leys" used in soap production. Ample directions are given for analysing and testing soaps, and the materials used in their manufacture; in fact, nothing is omitted which can be of use to the soap-maker. The book is well and honestly done, and deserves the considerable circulation with which it will doubtless meet.

Electrical Congress.—The adjourned congress to determine and adopt the length of a column of mercury of one square millimètre section, which represents the true ohm, met in Paris on Monday, the 28th ult. M. Mascart has made some measurements which agree very closely with Lord Rayleigh's, the latter being 106·24 and the former 106·33 centimètres. England is represented by Sir William Thomson, Professor Hughes, Professor Fleeming Jenkin, Captain Abney, Mr. Graves, and Mr. Preece.

At a recent meeting of the Berlin Physical Society, Prof. Landolt produced a cylinder of solid carbonic acid he had prepared about an hour before the sitting, and described the mode of its formation. From a Natterer compressing vessel a stream of liquid carbonic acid was made to penetrate into a conical cloth bag. The bag speedily got filled with a loose snow of carbonic acid, which was then, by means of a stamper, hammered together in a cylindrical vessel into a solid cylinder. Compact carbonic acid cylinders of this kind could be touched gently with the hand, and possessed the hardness of chalk, which, too, they resembled in appearance, and on account of their brittleness did not readily admit of being cut with a knife. The specific gravity of solid hammered carbonic acid was found to be 1·2.—*Engineer.*

A Singular Suicide.—On Saturday, April 5, an incident, perhaps unprecedented, took place at Stalybridge. Mr. Barnes, of the firm of Garside & Barnes, owned a fine retriever dog. A few days before, it exhibited symptoms of considerable suffering, and had difficulty in drawing its breath. Early on Saturday morning it made several attempts to get to the canal, but was fetched back to the house by Mrs. Barnes. Eventually, however, it succeeded in effecting its object, and plunged into the water. Several persons who witnessed the incident declare that the dog, although, like all its kind, able to swim with ease, kept its head persistently under water until it was suffocated. Attempts were made to get it out of the canal, but before these were carried into effect the animal was dead. The case is regarded as one of deliberate suicide. The opinion was that the animal had swallowed a piece of meat into which pins had been inserted, and that these had remained in the throat. Some attempt was made to discover if this theory was correct, but the *post mortem* examination was not made by skilled hands, and the search was unsuccessful.—From the *Ashton and Stalybridge Reporter* for April 12, 1884.

Herr S. von Wroblewski and K. Olszewski say the result which M.M. Cailletet and Raoul Pictet obtained in the liquefaction of the gases, lead to the hope that the time is not far distant when it will be possible to examine liquid oxygen in a glass tube as easily as we can at present look at a tube filled with carbonic acid in the liquid state. The one condition which must of necessity be arrived at is a sufficiently low temperature. In a paper published by Cailletet, he directs attention to fluid ethylene as a means of reaching an exceedingly low temperature. This gas, in a fluid state, boils under the atmospheric pressure at 103 deg., as measured by a thermometer of carbon disulphide. S. von Wroblewski has constructed an apparatus for higher pressures, in which considerably large quantities of gas can be subjected to a pressure of 200 atmospheres, and with this apparatus it is proposed to study the temperatures at the moment of expansion. The experiments soon led them to the discovery of a temperature at which carbon disulphide and alcohol became solid, and oxygen was rendered completely liquid with the greatest ease. This temperature is reached by letting liquid ethylene boil in a vacuum. The critical temperature of oxygen is lower than that at which the liquefied ethylene boils under the pressure of one atmosphere. From a number of determinations it was found that with a temperature of 131·6 deg. oxygen begins to liquefy at a pressure of 26·5 atmospheres; at 133·4 deg. it began to liquefy at a pressure of 24·8 atmospheres; and at 135·8 deg. it began to liquefy at 22·5 atmospheres. Liquid oxygen is colourless and as transparent as fluid carbonic acid; it is very mobile and exhibits a very beautiful meniscus. Carbon disulphide freezes at about 116 deg., and again becomes liquid at about 110 deg. Absolute alcohol at about 129 deg. is thick and viscous like oil, and at about 130·5 deg. solidifies to a firm mass.—*Engineer.*

Editorial Gossip.

WE have received from Mr. Thos. Foster a singular paper discussing the quaintly scientific suggestion of Dr. S. V. Clevenger, (formerly Professor of Comparative Anatomy in the Chicago University,) that man rose to the upright position ere yet his body was thoroughly adapted for the change. If Dr. Clevenger's theory runs on all fours man ought to have gone on all fours a little longer. Or, more hopefully, we may say that according to the doctrine of evolution, man has not yet reached his best, for where there is room for improvement, (and Dr. Clevenger has shown that there is) evolution is bound to work out that improvement, in the fulness of time.

THE *Cornhill Magazine* for May contains a very interesting instalment of Mr. Payn's "Literary Reminiscences." His experiences as editor of *Chambers's Journal* are exceedingly amusing. I think I could cap some of them with strange coincidences which have come to my own KNOWLEDGE. His troubles with impatient contributors whose accepted articles do not appear at once, are particularly amusing. He had an instructive experience of the sort himself, when a beginner (and very young), an accepted article turning into a rejected one, in response to two too earnest appeals for early insertion.

WHEN he was first associated with *Chambers's Journal*, Leitch Ritchie was the editor. Nearly always, writers who sent articles with expressions of admiration for the editor's writings, spelled his name incorrectly! We have no such way of testing our own admirers. But we *are* sometimes favoured with communications from admirers of the great Herschell, with two *l*'s, and with manifest unconsciousness that the Herschelian star is a noble binary—for those who know it.

WE get borrowed articles sent us as original ones time and again, but have hitherto not been caught napping that way. Stolen stories must be harder to detect. But probably Mr. Payn's experience in having a story sent him, under a new name, which had appeared in the very magazine he was publishing, twenty years before, is unique.

As an odd coincidence, Mr. Payn's reference to the "Vestiges of Creation" coming at the very time when the authorship has been acknowledged by the last survivor of those originally acquainted with the truth in the matter, is deserving of mention. "I have no doubt," Mr. Payn writes, "that he wrote the famous 'Vestiges,' though possibly in collaboration." Before these words appeared in the *Cornhill* the new edition of the "Vestiges" had appeared with its most interesting and amusing preface, in which the whole-and-sole authorship of Robert Chambers is acknowledged.

IN that preface mention is made of a MS. proving incontestably that Robert Chambers *could* not have been the author. That MS. was offered to us when KNOWLEDGE was but a few weeks old. We declined it on the plea that whether Robert Chambers could or could not have written the book he certainly *had* written it. The author of the MS. proved "incontestably" that Sir Charles Lyell had written the "Vestiges." But the *Wanganui Herald* took us seriously to task for not knowing that Professor Sedgwick was the author, his attacks on the work being "only pretend," as the little folks say.

IT is singular that so able a man as Robert Chambers should have had for brother and (apparently) as fellow-worker a man so shallow as William Chambers, under whose control (after Robert's death) *Chambers's Journal* lost caste seriously. His papers, as Mr. Payn truly says, were written in a bald style and full of platitudes. Yet Robert Chambers, with a family of eleven children (his "eleven reasons" as he once said for not acknowledging the authorship of the "Vestiges") "was dwarfed in the public eye beside his brother," who "being childless and of great wealth was enabled to perform certain public acts, which cast Robert, weighted with his large family, comparatively into the shade." Such is the unfair influence of mere wealth in this country.

I HAVE received, or rather the publishers of KNOWLEDGE have received, a further communication from the solicitor of Dr. Birley, as the earth-flattening "Parallax" now elects to be called. (I might be wronging "Parallax" by speaking of this name, rather than Tryon, Goulden, or Rowbotham, as his real name, or by giving an entirely different name as more genuine than any of the four; so for the present let the name "Parallax" be employed.) Mr. Rumney is surprised that after his former letter any further communication from Mr. Wolfson should have been inserted here. He overlooks the circumstance that his former letter stated that proceedings had been commenced against Mr. Wolfson, and that on the strength of this assurance, only, I decided to insert no letters from Mr. Wolfson till such proceedings had been concluded. As it turned out, Mr. Rumney was mistaken on that point.

I HAVE now conveyed to "Parallax's" solicitor my opinion that if "Parallax" is unwilling to avail himself of the facilities I have offered for contradicting *here* any misstatements here made,—over his very own name, of course—the best arrangement, in the interests of the public, is that the whole matter should be thoroughly ventilated by proceedings against myself, or (which would virtually be the same thing) against the publishers of KNOWLEDGE. If any statements made here are incorrect they cannot be too publicly set right, and I shall be right glad to help in any way towards that end. On the other hand if—whether through mistaken faith in nostrums or in special forms of regimen, or through ignorance of physical laws—"Parallax" has (in his "Patriarchal Longevity" or otherwise) promised more than can be safely attempted, it is well that this should be as publicly as possible set right.

As to the Flat-Earth nonsense, that is not and never has been worth the trouble of crushing. "Parallax" (as presumably, were his real name known, a medical man), will understand the opinion I have formed on that point, when I remark that his Zetetic Astronomy cannot even be described as still-born: it was never more than an abortion. But those who are foolish enough to be deceived by such reasoning (save the mark) as is found there, though none the worse for that, might be very much the worse if they were misled by false hopes of patriarchal longevity, apparently associated with the advent of one who has not rejected but openly quotes the definition of himself as "a greater than Newton." Hence have I held it my duty to touch on both sides of "Parallax's" public character, his claim to profound knowledge in matters of life and death, as well as his claim to super-Newtonian knowledge respecting astronomy. He is the author of "Earth Life" and "Patriarchal Longevity," as well as of the "Zetetic Astronomy"; and mistakes about matters medicinal are

apt to be very much more serious than erroneous ideas as to the shape of the earth.

HOWEVER, we shall soon know more about "Parallax" if he carries out his announced intention,—and perhaps whether he carries it out or not. If he insists on asserting that he has been wronged, and will not state where and how he has been wronged, I suppose I must endeavour to do him justice without such help. *Fiat justitia ruat cælum.*

IN the meantime, while resolute to discharge what I hold to be a duty, and a duty specially falling within the province of KNOWLEDGE (for true knowledge is as much advanced by the rejection of what is erroneous as by the assertion of what is sound) I have no wish, and it is no part of my business, to attack any man's private character. Nothing of the sort was intended, and I find nothing of the sort in Mr. Wolfson's remarks. He applied the term "quack"—with the complimentary adjective "accomplished"—to "Parallax"; but apart from the circumstance that the term relates to "Parallax's" public, not to his private proceedings, it is in itself an epithet of a very mild character. Hundreds of worthy men are quacks. Every man who publicly claims more for his remedies,—social, political, medical, or otherwise,—than they are really worth (and many even of the worthiest do so) is a quack. Nay if any man claims more for a remedy of any sort than another *deems* it worth, he is a quack in the eyes of this other. If the term "quack" signified one of those men who fraudulently assume the medical character, *and under that guise attempt cures or operations of a dangerous, or unlawful nature*, then doubtless it would be a very serious matter to apply it to any person, even though it might be known and could be proved that the implied accusation were well founded. But the term means nothing of the sort. It is certainly applicable without offence to one who has vended medicine for prolonging life beyond its natural term, and has associated the sale of such medicine with public promises of patriarchal longevity.

To assert of such a man what Mr. Wolfson asserted of "Parallax,"—that his real object is to put money in his pocket and that he is very careful of money so made,—is only objectionable in being unnecessary. The real object of every profession and of every trade is to gain money; it is a very proper object (meaning the support of life in self and family), and every wise man is careful of money so made. Only "a *fool* and his money are quickly parted."

AN INTERESTING DISCOVERY.—The Rev. C. W. Markham, of Saxby Rectory, Barton-on-Humber, writes to the *Banner*:—"Sir,—I beg to send you a brief description of a singular and interesting discovery in this neighbourhood. Some brickyard labourers in excavating clay on some level land in the valley of Aucholme, near Brigg, in Lincolnshire, have recently discovered, about 7 ft. below the surface, a very ancient wooden way. It consists of massive beams of oak laid tranversely, and fastened into the soil below—which is the glacial drift—by oak pins. This structure, which it is thought extends nearly a mile across the valley (which in bygone ages was no doubt generally covered with water from the Humber), is thought by some archæologists to be a relic of the Neolithic Man. Its age must be enormous—almost beyond calculation—as on the top of the wooden way is about 6 ft. of solid clay, and above the clay about 1 ft. of peat; and this peat was there at the time of the Romans, we know, as the Roman roads in the neighbourhood are laid upon it. This most interesting discovery can now be seen, but it is to be covered up very shortly, unless some steps should be taken by any learned society to preserve it; it is, I believe, on land belonging to the Earl of Yarborough.

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

THE EARTHQUAKE.

[1211]—I beg to record that at 9.18 this morning my iron bedstead was visibly shaken for about two seconds of time. The wardrobe, doors, and windows were also visibly affected, while a servant then in the room said she felt as if she were moved. The same thing was experienced by others in the upper part of the house, but downstairs nothing was noticed. I expect to-morrow either to hear of some great explosion or the occurrence of an earthquake.

Hill House, Long Melford, O. R. BREE, M.D.
Tuesday, April 22.

SIR J. HERSCHEL AND THE COMET OF 1862.

[1212]—Surely you are mistaken in regarding my father's remarks on the comet of 1862 as being based *on his own observations* "telescopically." I feel pretty certain that if he saw that comet in a telescope (of more than 2 in.) *at all*, it can only have been *casually* (*i.e.* in a neighbour's), as he had none in position at any time after leaving Slough in 1840. If I knew to which of his writings you refer, I should, of course, be better able to say if he is alluding to observations by himself, or as reported by observers in general. J. HERSCHEL.

[Lieut.-Col. Herschel's letter reaches me when away from my books. The passage referred to occurs in Sir J. Herschel's "Familiar Lectures on Science." Sixteen or seventeen years have passed since I read the passage, but I certainly am under a strong impression that he speaks of his own observations throughout. In part, he certainly does, as he refers to his "octogenarian eyes." But I am prepared to find that my memory, usually trustworthy, has played me a trick in this case.—R. P.]

THE OCCULTATION OF VENUS, &c.

[1213]—I see in KNOWLEDGE, in the article on "Occultation in a Three-inch Telescope," by "F.R.A.S," in the second column, on page 268, he refers to the occultation of Venus which took place on February 29 last, and says that no intimation or prediction of it whatever was given in the "Nautical Almanack". As this statement is scarcely accurate you will, perhaps, in justice to the "Almanack," allow me to correct it. The occultation certainly is not mentioned among the "Occultations visible at Greenwich," on page 435 of the "Almanack," and why it is not I am at a loss to understand; but if "F.R.A.S." will turn to page 408, under the heading of "Elements of Occultations," he will there find it duly mentioned. I may add that this is not the only instance of occultations which are actually visible at Greenwich, being entirely omitted from the list of those visible at Greenwich in the "Almanack," for I have personally witnessed several occultations of stars which are duly referred to in the "Elements of Occultations," and yet not mentioned at all under the heading of "Occultations Visible at Greenwich." Why they are omitted from the latter list I cannot comprehend.

While writing, I may mention that I was somewhat disappointed on opening my KNOWLEDGE to-day, for as the planet Mercury is just now coming into a very favourable position for observation I fully expected "F.R.A.S." would have given us, this week, his long-promised paper on "Mercury in a 3-in. Telescope." May we hope to have it next week? I may add that I found the planet with my telescope last evening (April 17), and also saw him with naked eyes afterwards.

I noticed that in last week's KNOWLEDGE you invited suggestions from correspondents as to the "Constellation Maps," which you propose to publish, so I may as well give you mine. I think the black ground should only be inside the circle, and that the maps should contain no marking at all beyond the stars themselves (without letters or names), the constellation figures, and the constellation outlines. I notice that you favoured the exclusion of the outlines, but I should prefer them to be shown. EXCELSIOR.

COINCIDENCES.

[1214]—I have for many years made a practice of jotting down coincidences, and I believe I could cap almost anything in that way that might be offered. I will mention one only.

On my last return to India, the season being unfavourable, my wife followed at an interval of some months, stopping on the way at Colombo and at Madras, and eventually at Calcutta; while I was up country at Dehra. This occasioned considerable uncertainty in correspondence, which, owing to her bad health, caused me great anxiety; and on one occasion, this failure of letters, with other causes, led me to doubt the local post-office. It is these other causes that I have now to relate. Soon after returning, I wished to communicate with friends in different parts of the country; and in particular, I wrote to two ladies, one at a hill station, and the other at a station in the plains, whom I may designate as Mrs. A. and Mrs. B. respectively. My letters were despatched at some considerable interval. I was thus writing to three ladies in widely different parts about the same time, and it so fell out that at the period of my greatest distress at non-receipt of letters from my wife I was also so perplexed at receiving no answers from the other ladies as to cause me to make minute inquiries to ascertain whether my own letters had been duly posted. However, to cut the matter short, I at length got my expected letters—*all three by the same post*, of which there were two deliveries daily. This might of itself be regarded as a curious coincidence enough, but it was heightened by the contents of the letters—that is, of two of them; for Mrs. B. mentioned casually that an acquaintance was breaking up his establishment prior to going home, selling horses, &c., while Mrs. A. wrote *inter alia* that she was hourly expecting to hear of having succeeded in purchasing a horse advertised for sale; and although the writers were utter strangers, it was clear (as I afterwards proved, to the no small surprise of the latter) that the two references dovetailed, and supplemented each other. Whatever may be thought of the primary coincidence, I think it will be allowed that the secondary one was worthy of note. It is only unfortunate that it cannot be told in a fewer number of lines. It naturally appeared even more striking to myself, under the peculiar circumstances, than it can do to any casual reader barely realising the chief features.

I think, by the way, as to coincidence *versus* the supernatural, that it is worth considering that no true coincidence ever strikes any one as in any sense or way supernatural. This does not prevent other combinations being regarded *by some* as supernatural, and *by others* as mere coincidence.

J. HERSCHEL, Lieut.-Col. R.E.

[1215]—Here is a double coincidence which has just happened to me. I am not sufficiently a mathematician to estimate the chances against the double events, but they must be very considerable.

I and my boys are bicyclists. One Saturday afternoon last autumn, I and my eldest son rode, for the first time, to Shenley, in Middlesex. We had tea at the Black Lion, and as we were finishing the Hornsey B. C. arrived at the same house. After tea we rode to the top of Ridge Hill, where dismounting, we were greeted by a friend, Mr. H——, a "riding acquaintance," and quite unconnected with the Hornsey B. C.

Last Saturday, while on the road, we made up our minds to visit Shenley for the second time. We tea'd at the Black Lion, during which repast the Hornsey B. C. arrived. I remarked on the coincidence, and said, "It will be funny if we should see Mr. H—— at the top of Ridge Hill." We rode there, and, as we turned sharp round from the by-road to the summit of the hill, there stood Mr. H——, ready to welcome us!

I may add, that between whiles we had neither seen nor had any communication either with the Club or with Mr. H——.

EDWARD MARKS.

[I note with interest the experience of others as to coincidences—so odd, did we overlook the immense number of *events* among which they turn up, that the idea *will* suggest itself that there is some special meaning in them.—R. P.]

COOKING CHEESE.

[1216]—Observing in this week's KNOWLEDGE that some one has tried Mr. Williams's suggestion with regard to cheese cookery and failed, give me leave to state that we also have tried it and with complete success. The dish was very palatable, nourishing, and wholesome. May I ask, did Mr. Carter prepare the dish himself, or leave it to his cook? Also, was the baking left to the cook, as much depends on this. I ought, perhaps, to add that owing to difficulty in procuring bi-carbonate of potash in our village, we omitted this item; otherwise, we followed implicitly the directions given by Mr. Williams, and with highly satisfactory results.

ETHEL E. ELLIS.

[1217]—Can only suppose your correspondent, J. P. Carter, was not sufficiently careful in following the instructions of Mr. Williams in his preparation of dish of cheese with bicarbonate of potash, nutmeg, &c., &c.; otherwise he would have been as successful as I was, and enjoyed a tasty, digestible, and inexpensive dish. It would be unfair to Mr. Williams, I think, to let a complaint appear and not put a word in on the other side. R. T. PALMER.

London, April 22, 1884.

THE POTATO IN IRELAND.

[1218]—I have waited until to-day, April 12, to see if any of your readers would bring Mr. W. M. Williams to task for a statement made by him, in his article on the Chemistry of Cookery in your paper of March 28, on the use of the potato by the Irish people. In your issue of April 11, one who signs himself "A Resident Irishman" refers to Mr. Williams's views in same article concerning the absence of fruit-trees and the cause thereof, and points out that by the existing laws farmers are fairly well protected, and that it is not the fault of the laws that fruit-trees are not more cultivated in this country. I shall not refer to this portion of Mr. Williams's paper further than to mention that the county of Armagh is a notable exception in this respect to many other parts of Ireland. In this county, fruit-trees are largely planted, particularly apple-trees—it is quite a common sight to see from one to ten acres under this fruit alone. The rent of the entire farm is frequently paid from their sale. They are usually sold to dealers who come from England and Scotland early in the summer, when the fruit is barely formed, and who purchase the entire orchard, taking all the after risks of the crop. Owing to the absence of sunshine during the past few years, it has not been a profitable business to any of the parties concerned.

The portion of Mr. Williams's paper I consider objectionable reads as follows:—"My own observations in Ireland have fully convinced me of the wisdom of William Cobbett's denunciation of the potato as a staple article of food. The bulk that has to be eaten, and is eaten in order to sustain life, converts the potato-feeder into a mere assimilating machine during a large part of the day, and renders him unfit for any kind of vigorous mental or bodily exertion. If I were the autocratic Czar of Ireland, my first step towards the regeneration of the Irish people would be the introduction, acclimatisation, and dissemination of the Colorado beetle, in order to produce a complete and permanent potato famine." It is to this latter portion of Mr. Williams's views I particularly wish to refer.

The regeneration of the Irish people has been a very prominent theme for some time, from a certain autocratic Czar of Ireland down to the Irish-American Dynamiter, who proposes to effect the regeneration of the country by applying explosives to public buildings in England. Verily the regenerators are numerous and their modes various; but the Colorado beetle is the latest suggestion of all. Coming as it does from a scientific man in the columns of KNOWLEDGE, it should not be allowed to pass unchallenged. I do not know whether Mr. Williams is a young or an old man, but he says he explored the country rather exhaustively. His statement to be true must be carried back to a time previous to the year 1846.

I have been intimately acquainted with the social condition of the Irish people in the northern half of Ireland for more than twenty-five years, and have known a considerable portion of Ulster for a much longer period, and can state from my own knowledge that the people now, and for a long time past, do not live on the potato in the way indicated by Mr. Williams. Since the potato blight of 1846, the Irish people have been gradually dispensing with the potato as a staple article of human food.

There are some districts in the counties of Donegal, Mayo, and Galway where this improvement, however, is not quite so apparent. It would be almost as unjust to make a similar charge against the Scotch, because the crofters of Skye and Lewis live in pretty much the same manner. I admit the potato is still a staple crop in Ireland, and deservedly so, but not a staple of human food as it was previous to the blight. As a proof of the importance of this crop, which Mr. Williams proposes should be destroyed, the loss on

the crop in Ireland, owing to the partial failure in 1879, was over two million pounds sterling. The English people must be fond of potatoes also, as it appears from the Board of Trade returns there was considerably over one million cwt. imported into England from France and Germany alone, during the first three months of last year, while the imports from the same countries this year, for the corresponding three months, is about 295,000 cwt., not much over the one-fourth, Ireland, no doubt, making up the balance from the splendid crop of last autumn. Mr. Williams admits that 14 lb. of potatoes are about equal in nutritive value to a 4 lb. loaf. The value of 14 lb. of potatoes in Ireland this year is from 2½d. to 3½d., according to quality. The 4-lb. loaf is 6½d.; consequently they are relatively much cheaper than bread, and the increase in the exports to England are consequently very marked. Poultry, pigs, and cattle are largely fed with potatoes; they are now the real assimilators, as the farmer finds it profitable to convert his potatoes into fowl, bacon, and beef, for which there is an unlimited demand. The food of the people consists principally of Indian and oaten meal, flour, potatoes, bacon, tea, and in a less degree of eggs and butter, as they are usually sold. The Indian meal makes porridge, also a very wholesome bread is made from about equal quantities of it and flour, using sour butter-milk and carbonate of soda instead of barm. From oaten meal is made porridge, flummery, and oaten cake, which is a very sustaining food. Another kind of bread made in Ireland is potato-cake. It consists of potatoes, finely bruised, mixed with about one-fourth their weight of flour, a little salt added. It is baked on a griddle, and is served up when hot with plenty of butter. It is very agreeable to eat, and quite wholesome. Wheaten bread is also made. Potatoes are used as a general rule only at dinner. The Irish people use plenty of butter-milk, which is the milk that remains after churning and taking off the butter; it is used as well for pigs, calves, and poultry, and can be safely recommended to the human subject as one of the very best medicines for a sluggish liver. The workpeople in the towns live more exclusively on tea and bread and butter; their food is not so varied or so wholesome as that of the country. It is well known that since the introduction of the potato, skin diseases have almost disappeared where they are used. The *Lancet* recommends that shipowners should be compelled to carry them, as one of the best antiscorbutics. Without multiplying words further, it cannot be denied that their moderate use is highly beneficial, and that to talk of introducing the Colorado beetle is simply nonsense. I deny that the Irish people eat inordinate quantities of potatoes; they use more of them, however, than the English, with whom they will compare in every respect—in physique, intellect, and intelligence. Instead of trying to exterminate the potato, which is so valuable for all feeding purposes about a farm, an effort is at present being made by a Belfast gentleman, who has spent years of his valuable time and a great deal of his means to introduce new varieties from the seed, which are more proof against disease than the older sorts.

This gentleman had the co-operation and sympathy of the late distinguished naturalist Mr. Charles Darwin during his various experiments in growing the potato from the potato-apple, and he is reported to have said that the loss of some of these new varieties would be nothing less than a national calamity. I will conclude by expressing a hope that Mr. Williams may favour us with a visit, that he may observe the progress made in the social condition of the people, and see sufficient to cause him to change his views about the extermination of the potato. SEATON F. MILLIGAN.

FRUIT TREES IN IRELAND.

[1219]—If Mr. Matticu Williams had, in No. 1191, stopped short at ridiculing and denouncing what he calls my "curious theory," I should not have troubled you again. I never meant to do anything so arrogant as to propound a theory. I know all the facts he recites, and will make him a present of one which he has not mentioned, though possibly he is aware of it. There is (or was in 1875, when I saw it) a clump of bamboo in Muckross demesne, Killarney. I have propounded no theory; but I did mean to throw out a suggestion, and I will try to make my meaning clearer now. Does Mr. M. W. think that in Ireland fruit is likely to ripen with such steadiness and certainty that farmers could reckon on it as a source of profit or an auxiliary to diet? If he will say this, I will admit that I have been wrong in my *conjecture*. Theory I have none, and I am willing to defer to Mr. M. W. as an expert.

If I were the arrogant person he supposes me to be, I should, in my turn, ask him to defer to me, as one who has given special study to the laws of land tenure and the relations of landlord and tenant in Ireland. I do not ask this; but I think I am justified in challenging Mr. M. W. to name a sufficient number of instances where farmers' rents are raised, or a rise of rent was threatened, because fruit trees were planted on the farm. There are more than 500,000 tenant farmers in Ireland. Does Mr. M. W. know of 500 cases—one case in a thousand? Does he know of one case in 10,000? Can he name fifty cases where this was done or attempted? It is very remarkable that no mention of anything of the kind occurs in the evidence of the Richmond and Bessborough commissions, or in the pamphlets of Mr. Baldwin, the great champion of the small farmers.

I cannot ask you for sufficient space to expose the mis-statements and bad reasoning of Mr. M. W.'s concluding paragraph. But I must protest against the introduction of the late Earl of Leitrim's name. I cannot, and would not if I could, undertake to defend his conduct to Lord Carlisle; but what has an incident which took place in 1863 to do with the Land Act of 1870? Mr. M. W. writes that I "must know how the Earl of Leitrim publicly announced his intention of defying and violating the law of 1870, and how he proved his feudal power over his tenants by commanding them to publicly and ostentatiously insult the Lord Lieutenant, &c., &c., &c. . . . This was done to demonstrate his contempt for that same law which . . . any one of his tenants could enforce against him." Would not any one believe, reading Mr. M. W.'s words, that (1) Lord Leitrim *first* declared his intention to violate the law of 1870, (2) *then*, to show his contempt for the law of 1870, insulted the Viceroy, and (3) carried out the insult by a public demonstration of his tenants? This is the natural meaning of the words as they stand—What are the facts? The insult to the Viceroy, Lord Carlisle, took place in 1863, seven years before the Land Act of 1870 was enacted. It was carried out through a *single tenant*, who was a common innkeeper, and may not, for anything on record, have held a rood of land under Lord Leitrim. The licence of the inn was taken away at the next meeting of licensing justices. Mr. M. W. must be infatuated in his hatred of Irish landlords when he has recourse to such weapons of attack as this. It is quite true that Lord Leitrim did defy the Act of 1870; but he was in all respects an exceptional man. To quote him or any act of his as typical of Irish landlordism proves either ignorance or hastiness of judgment. Ignorance cannot be presumed in Mr. M. W.'s case. He has "explored Ireland" and edited Murray's Handbook—my authority, by the way, for the date and for some of the facts mentioned above.

I never accused Mr. M. W. of "joining in denunciations of the Saxon." I said, and I repeat, that he has lent his ears to false charges against Irish landlords as a class, and that he is now lending his pen to disseminate the like falsehoods. I am willing to believe that he thinks they are truths; but that is because he has not examined the evidence. Judging a whole class by an exceptional individual, he has accepted without inquiry any story told him to the discredit of that class.

Possibly Mr. Williams may refuse to meet my challenge, alleging that it is the *fear* of landlord "brigandage," and not the actual fact, which kept men from planting. If so, how does he account for fruit-trees on farms in England where there is no Registration Act, and no Act of 1870, but the fruit-trees are "the landlord's property"? This opens up the whole question of tenure and the relations of landlord and tenant in the two islands, and you will say that KNOWLEDGE is not a legal or political paper. That is not my fault. Mr. Williams was the first to introduce legal and political matter in his cookery article, and his letter (1191) repeats and adds to the irrelevancy. RESIDENT IRISHMAN.

MAN DURING THE GLACIAL PERIOD.

[1220]—With regard to Mr. Kirkdale's letter inquiring the *locality* of any glacial deposits containing remains of human workmanship, parenthetically referred to in my article on "Effects of the Glacial Period," and my *authority* for such reference, I may mention specially Prof. Rutimeyer's description of certain traces of man in the interglacial deposit near Wetzikon, in the Canton of Zurich, Switzerland. Such traces consist of pointed lignite rods, considered by Prof. Rutimeyer, who, along with his colleague, Prof. Schwendauer, very minutely examined the same, as undoubtedly the remains of some rough basket-like structures. They were discovered by Dr. Scheuermann in a lignite formation at Wetzikon, overlaid by a vast glacial deposit, described some years ago by Prof. Arnold Escher de la Linth. The lignite also rests upon a bed of an erratic nature, and is, in fact, an "interglacial" deposit. Besides the lignite rods referred to, remains have been found in this deposit of the elephant, rhinoceros, urus, and other animals often found along with the implements of man in other parts of Europe. ROBERT B. COOK.

SCIENTIFIC MORALITY.

[1221]—Although I have been a constant reader of KNOWLEDGE from the beginning, and have been interested to watch its development, I have not hitherto troubled you with any observations. I can no longer refrain, however, from expressing the satisfaction it has been to see that you do not exclude conduct and morals from the domain of scientific knowledge. I heartily agree with your

correspondent, Mr. T. Common, when he says, "Scientific morality is the true antidote to revolutionary ideas." But, what I wish to draw attention to is that this antidote must be administered *before* the poison has taken hold of the system; that is to say, *children* must be taught the principles of right conduct, and trained to act in accordance with those principles, before they become entangled, as men and women, in the meshes of revolutionary or communistic ideas.

That such teaching is practicable has been amply proved in the Birkbeck Schools (founded by my grandfather, the late Mr. William Ellis), where the systematic teaching of the "Conditions of Well-being" is a prominent feature. I myself know by experience that even young children can be brought to understand and take delight in such lessons, which, in the words of Mr. T. Common, "may determine the whole course of a person's life."

Mrs. Fenwick Miller (M.L.S.B.) has been struck with the importance of such training, and has lately made an attempt—but partially successful, I regret to say—to introduce it to our Board Schools. Perhaps, some day, they will decide that conduct and duty teaching is as needful as perspective drawing and Shakespeare; but, as the public seem hardly ripe for this yet, it is to such enlightened pioneers as KNOWLEDGE that philanthropists must turn for aid in arousing people to a sense of the importance of teaching Scientific Morality.

ETHEL E. ELLIS.

WOLFSON *VERSUS* BIRLEY.

[1222]—It is not because my name has been incidentally mentioned in this matter that I now venture to claim permission to trespass on your space, but for the very good reason that I have been frequently, and am now, by many who ought to know better, regarded as the individual publicly known as "Parallax." But I have never in my life used this or any other name than my own. And, much as I am indebted to him for helping me to discover one of the greatest impostures of the day, I have not the slightest ambition to be identified with his unaccountable reluctance to pass in his own name. His conduct to me individually has been the very reverse of generous or equitable. Some twelve or fifteen years ago, when "Parallax" had not, perhaps, as many sixpences as he now has pounds, I paid him some £130 or £140, when I thought of placing my son as his pupil, besides spending an additional £30 in advertising his book by a pamphlet of extracts, entirely trusting to his honour to make me some compensation, if the time should ever arrive, when he should be able to do so. All the return I have had has been one pint bottle of his phosphorised medicine, and the privilege of having my name identified with the grand cause of which he is the unquestionable founder. I have letters from him at this very time, acknowledging how cordially and highly he approved of the selections I made from his book.

From these facts it may be gathered that I have not the slightest reason to place myself before your readers as Dr. Birley's champion, much as I admire him as a true scientist, and also for his medical skill, unprofessional as it may be. He is only one out of hundreds of others who are deservedly making good incomes out of medical compounds that may not be intrinsically worth much more than the glass bottles which contain them. When rich and suffering people are cured, they do not care about the actual cost of the physic so much as the cure effected. As for exposing the Zetetic cause, Mr. Wolfson may [as well], as I have told him, attempt to blow up Hampstead-hill with wet sawdust. And his inevitable failure will, I trust, be a lesson to him not [to] make threats till he has made sure of his ability to carry them into execution. With respect to the chief cause of his disagreement with "Parallax," I suspect [but Mr. Hampden's suspicions are not evidence, and must be omitted.—R.P.].

But, as I said before, Dr. Birley ("Parallax") has no claim on my interference on his behalf; and why he is silent, I cannot for a moment conjecture. But a man of 89 years ["Parallax" certainly did not look 69 at Plymouth in 1864. Surely Mr. Hampden must mistake, or "Parallax's" medicine has aged him tremendously in the last twenty years. I should have said he was not 60 then.—R.P.] is less inclined for letter-writing than he was half a century ago. Yet I think Mr. Wolfson ought to be grateful for his forbearance, if my informant is correct. [Mr. Wolfson is not enthusiastically grateful to "Parallax"; so probably Mr. Hampden's informant is *not* correct.—R.P.]

JOHN HAMPDEN.

[I have much pleasure in finding space for Mr. Hampden's letter. He surely ought not to be confounded with "Parallax," considering the pamphlet in which the latter sat upon him, after the manner of speaking, for the Bedford Level wager. There "Parallax" describes very naïvely the simple way in which Mr. Hampden handed himself over as an early victim of the most childish paradox which has ever yet, probably, been propounded. I sympathise heartily with Mr. Hampden for the loss of his money, and still more for the association of his name with a cause which has so long been a laughing-stock for intelligent persons. (I have myself never heard it spoken of except with well-deserved ridicule.) But I venture to congratulate Mr. Hampden on the limited allowance of phosphorised medicine which he permitted himself to imbibe. All such medicines are dangerous when administered by unprofessional persons. Perhaps outsiders may understand *now* why "Parallax" has advocated an astronomical theory which—as I have again and again pointed out, both here and in the *English Mechanic*—he does not himself believe in (for otherwise he would not bolster it up with pretended and impossible experiments, and carefully garbled extracts). They may also understand why I have thought it worth while to show the absurdity of a theory which in itself is not worth the trouble of attacking.—R. P.]

LETTERS RECEIVED.

SENEX. Mr. Croll is quite right. The perihelion does not advance regularly, as so many of the books say, and often retrogrades. The length of the anomalistic year necessarily varies as these changes take place. I have thought of giving occasional diagrams showing the positions of the planets. Once a month would be unnecessary,—and the four outer planets could be sufficiently dealt with once a year.—THOS. AYERS. Hope the army of geologists will not utterly destroy you.—AB. HOLDEN. John Hill's "Arithmetic," published in 1750, may be mentioned in the catalogue of the British Museum. —W. H. FUNLING. Could not well publish astronomical notes a month in advance. The Kite problem would take up too much time and space. It is not by any means easy; but those who could follow the solution would be able to solve it for themselves.—J. C. MURRAY AYNSLEY. Your letter is marked for insertion.—H. WOODROFFE. On January 1, 1800, only 1799 years and part of a day had passed from the epoch when the present method of reckoning years starts. Now 1799 years are not eighteen centuries. It is clear that not until the end of December 31, 1800, have eighteen centuries been completed. Hence January 1, 1801, was the first day of the present century.—JOHN BELL. Thanks for kindly wishes. The price of KNOWLEDGE runs so close to cost of production that it would be impossible to bring out such supplementary illustrations. Consider, the *Illustrated Science Monthly*, which claims to be the cheapest science paper going, gives for sixpence no more *in mere quantity* than we gave last week for threepence, and its writers are not quite so well known as Messrs. Slack, Grant Allen, Williams, &c.—A. F. RAVENSHEAR. Fingers, &c., in due course. —H. Mystery of the infinitely small! Who can solve it?—E. BASIL LUPTON. The sun and moon appear larger near the horizon by an optical illusion,—the horizon seeming far away than the region overhead, yet the sun and moon no smaller. Hence they seem nearer than the sky, and the mind somehow translates this into seeming larger, being misled by the contrast between what is seen and what had (unconsciously) been expected. When measured by any angle-measurer the discs are found to be no larger, the moon's perceptibly smaller.—F. A. M. The proof that gravity acts with very much greater rapidity than light travels is not very difficult. A little consideration will show you that, if gravity acted as rapidly as light travels, the action of gravity would not tend towards the sun's centre, any more than the rays of light which show us the sun show his real place. There would be a constant force tending to accelerate the motion of the earth in her orbit.—L. KENNEDY. I can only say that I would not believe my own senses if such evidence seemed given me by them.—M. J. HARDING. The changed quality of paper will not affect the look of volume; the thinner paper was always used for numbers having 32 pages.—H. A. BULLEY. (1) All vulcanian phenomena are attributed by Mallet, Dana, and others, to heat generated by the mechanical displacements as the earth contracts. (2) Do not know the origin of the word CAUCUS: the Greek origin you suggest seems, as you say, rather wanting in connection.—J. H. M. (or J. HILL). Printers' errors cannot always be corrected in a paper coming out weekly. Articles may not be seen in proof, or corrections may be not quite correctly made. With books it is different because revises are seen. Scintillation has been treated since you wrote from Bombay.—J. H. Your coincidence story is curious. I have put it as a letter with names omitted as you wish. —F. STIFF. Thanks; but extract had already reached us.—V. A. WRAIGHT writes that he would be glad if any readers of KNOWLEDGE would furnish him with a few instances of catalysis.—LIEUT. M., ROXY, SW., and ST. HELEN'S. Thanks for the information obligingly conveyed; we have, however, more precise information still: his past has been traced farther back than you seem aware.—J. HALSWELL. The derivation of Jack o' Dover from *chef-d'œuvre* is likely enough to be correct.—POLYGLOT. Your article on the Patent Law shall be forwarded to you in type for correction. Thanks.

Our Mathematical Column.

NOTES ON EUCLID'S FIRST BOOK.

By RICHARD A. PROCTOR.

(*Continued from p. 276.*)

PROP. 32 is very important, as are its corollaries. It is well to notice that the second corollary gives the easily remembered result that—

Each of the exterior angles of a regular polygon of n *sides, is equal to* $\frac{4}{n}$*ths of a right angle.*

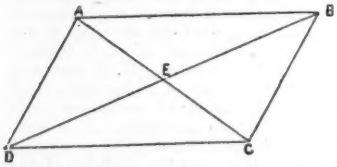
We shall refer to this result as Euc. I., 32, cor. 2, *schol.* As an instance of its application, take the following,—

Each exterior angle of a regular heptagon is $\frac{4}{7}$ths of a right angle; hence each of the interior angles is equal to $\frac{10}{7}$ths. (Euc. I., 13). Hence, also, the sum of the interior angles of a heptagon is equal to ten right angles.

The method here followed is the most convenient in cases of this sort, being so easily remembered.

To the properties established in Prop. 34, and their converse theorems, we may add the following,—

PROP. XVIII.—*The diagonals of a parallelogram bisect each other.*



Let A C, B D, the diagonals of the parallelogram A B C D, intersect in E. Then shall A E be equal to E C, and D E to E B. In the triangles A E D, B E C, the vertical angles A E D, B E C are equal, the angle A D E is equal to the alternate angle E B C, also A D is equal to B C. Hence (Euc. I. 26) the triangles are equal in all respects. Therefore A E is equal to E C, and D E to E B.

The converse of this property is also true. It is,—*If the diagonals of a quadrilateral figure bisect each other the figure is a parallelogram.* It is clear that if A E is equal to E C, and D E to E B, then since the angle A E D is equal to the angle B E C (Euc. I. 15), the triangles A E D and B E C are equal in all respects (Euc. I. 4). Hence A D is equal to B C and the angle D A E is equal to the angle E C B; therefore A D is parallel to B C (Euc. I. 27): and since A D is equal and parallel to B C, A B is equal and parallel to D C (Euc. I. 33): therefore A B C D is a parallelogram.

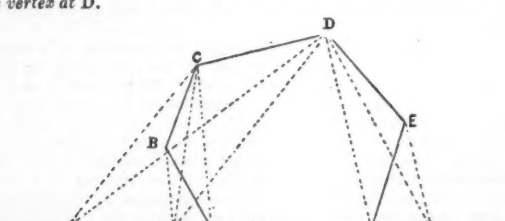
We shall refer to this proposition as Prop. XVIII. *conv.*

PROP. XVIII. and its converse are propositions of great utility, and the student should always be on the watch to apply them in problems of a certain class. Examples will be given further on.

Props. 35—41, and the converse theorems already discussed, are of frequent application.

Props. 42, 44, 45, have a useful application in surveying; since by taking the given angle as a right angle we learn how to reduce any rectilinear figure into a rectangle of equal area,—and, if necessary, of given length or breadth. The fourteenth proposition of the second book shows us further, how to construct a square equal to any given rectilinear figure. Hence these propositions may be looked on as completing the theory of the quadrature of rectilinear figures. But the following method of reducing a rectilinear figure to a triangle of equal area is worth noticing for several reasons.

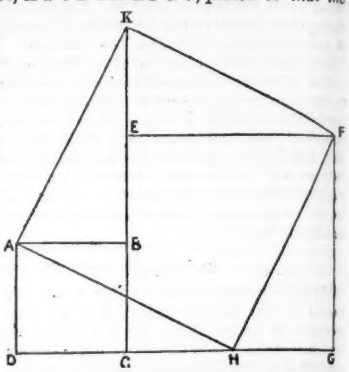
PROP. XIX.—Prob. *To reduce a rectilinear figure* A B C D E F *to a triangle of equal area, having its base in the line* A F *produced and its vertex at* D.



Produce A F indefinitely either way to G and H. Join C A, through B draw B K parallel to C A, and join C K; then the triangle A K C is equal to the triangle A B C, and (adding A F E D C to these equals) the figure F K C D E to the given figure A B C D E F. Again, join D K, draw C L parallel to D K and join D L; then the triangle K L D is equal to the triangle K C D, and (adding K F E D to these equals) the figure F L D E to the figure F K C D E, that is to the given figure. Lastly, join D F, draw E M parallel to D F and join D N; then the triangle D F M is equal to the triangle D E F, and the triangle L D M to the quadrilateral L D E F, that is to the given figure A B C D E F. And, in like manner, a figure of any number of sides may be reduced to a triangle.

It is hardly necessary to point out the importance of props. 47 and 48. The following problem, forming a well-known "puzzle" exhibits an interesting proof of the 47th proposition.

Let there be two squares, A B C D *and* E F G C, *placed so that the sides* D C, C G *are contiguous and in one straight line, and therefore* B C *and* E C *coincident. It is required to draw two straight lines, dividing the figure* A D G F E B *into three portions, which can be so combined as to form a single square.*



Take D H equal to E F, so that H G is equal to D C. Join D H and H F; then the figure is divided as required. For let the triangle A D H be placed as at A B K with its right angle coincident with the right angle A B E, the side A D being so placed as to coincide with A B. Join K F. Then B K being equal to D H, that is to E C, E K is equal to B C (that is, to H G); also E F is equal to F G, and the right angle K E F to the right angle H G F. Hence the triangle K E F is equal in all respects to the triangle H G F. Thus the figure A K F H is made up of three figures equal to those into which the figure A D G F E is divided by the lines A H, H F. Also A K F H is a square. For the four triangles A D H, F G H, K E F, and A B K being obviously equal in all respects, the four lines A H, H F, F K, and K A are equal. And each of the angles of A K F H is a right angle. For the angle K F H is equal to E F G since K F E is equal to H F G; K A H is equal to D A B, since K A B is equal to D A H; and A K F is the sum of the angles A K B, E K F, that is of the angles K F E, E K F, which together make up a right angle (Euc. I., 32): hence also A H F is a right angle, and A H F K is a square.

Of course this problem is, in effect, a proof of Prop. 47.

EASY RIDERS ON EUCLID'S FIRST BOOK,

With Suggestions.

PROP. 23.

65. If one angle of a triangle be equal to the sum of other two the triangle can be divided into two isosceles triangles.

66. Construct a triangle having given the base and the two angles adjacent to the base.

67. Construct a triangle having given the base, an angle adjacent to the base, and the sum of the two sides.

68. Construct a triangle having given the base, an angle adjacent to the base, and the difference of the two sides,—first when the greater side is adjacent to the given angle, secondly when it is opposite to that angle.

PROP. 24.

69. Prove that the point F in the figure to this proposition falls below E G.

70. Show how the proof of the proposition may be completed without assuming that F falls below E G.

In dealing with the assumption that F may fall within the triangle D G E, apply Euc. I. 21.

A BOARD of Trade report has been issued on the explosion of a vertical steam boiler in a printing office at Great Yarmouth, Norfolk. The boiler was reduced to from 0·094 in. to 0·125 in. in thickness, and burst at some pressure between 40 lb. to 50 lb. In his evidence the foreman said:—"I did not know whether it was fit for that pressure or not. About six or seven months ago I held the safety valve down by hand, and raised the pressure to 70 lb. by gauge. After that I was satisfied that the boiler was safe." This foreman, thinks the *Engineer*, would probably look for a gas escape with a lighted candle, put himself on ice to see if it were strong enough to carry considerable weight, and put a match on a keg of gunpowder to see whether it was wet or dry.

Our Chess Column.

By MEPHISTO.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

S. B. B.—Received with thanks.

Correct solutions received.—Problem I., p. 278, Donna, M. T. Hooton, W. Hanrahan, Julius Wahltuck, W., John Watson. No. II., John Watson, W., M. T. Hooton, Punch. No. 116, M. T. Hooton, W.

Solutions of Ending, p. 299, received from C. H. Brockelbank, W. H. L. M. (Dublin), and W.

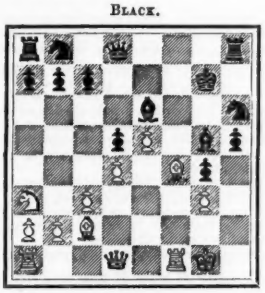
Two of our correspondents assert that White's victory is more apparent than real; in other words, that in spite of White forcing a Pawn to Queen, he can only draw. We shall fully enquire into this next week. But as this does not affect the idea of the Problem, we still invite solutions.

ONE of twenty games played simultaneously at the North London Chess Club, Mephisto winning seventeen, drawing one, and losing two (to Messrs. Biaggini and Griffiths). Time, 3½ hours.

ALLGAIER THOROLD.

White. Mephisto.	Black. C. H. B.	White. Mephisto.	Black. C. H. B.
1. P to K4	P to K4	13. Kt to R3	B to K3
2. P to KB4	P × P	14. P to B3	P to KR4 (*c*)
3. Kt to KB3	P to KKt4	15. B to B2	Kt to KR3 (*d*)
4. P to KR4	P to Kt5	16. Q to Q2	B × B (*e*)
5. Kt to Kt5	P to KR3	17. R × B	R to B sq
6. Kt × P	K × Kt	18. QR to KB sq	Kt to Q2
7. P to Q4	P to Q4	19. R to B6 (*f*)	R × R (*g*)
8. B × P	B to Q3 (*a*)	20. Q to Kt5 (ch)	K to B sq
9. P to K5	B to K2	21. Q × Kt (ch)	K to K sq
10. B to Q3 (*b*)	B × P (ch)	22. P × R	Kt × P (*h*)
11. P to Kt3	B to Kt4	23. R × Kt	Resigns
12. Castles	K to Kt2		

BLACK.



WHITE.

Position after Black's 15th move.

NOTES.

(*a*) This move has the merit of avoiding the various attacks following upon Black playing P × P by B to B4 (ch). Nevertheless B to Q3 cannot be considered a good move, as by P to K5 White obtains a strong centre and gains time.

(*b*) No doubt P to KKt3 was a safe move, but B to Q3 has a relative value, inasmuch as it gains time for development, and prevents QB to B4.

(*c*) To enable him to play his Knight to R3, and, if necessary, to play B to B4 and R to B sq.

(*d*) See Diagram.

(*e*) 16. Kt to B2 looks a safe move. White would reply with R to B2, to be followed by QR to KB sq.

(*f*) Threatening, Q × Kt or Q to Kt5 (ch).

(*g*) Black has nothing better. If Kt × R, then Q to Kt5 (ch) would win. Kt to B2 would likewise lead to loss.

(*h*) White might have continued with 22. Kt to B sq 23. Q to Kt7 / Q to Q3 24. K to Kt2 / P to R3 25. R to K sq / K to Q sq &c.

PROBLEM No. 117.

By H. W. SHERRARD.

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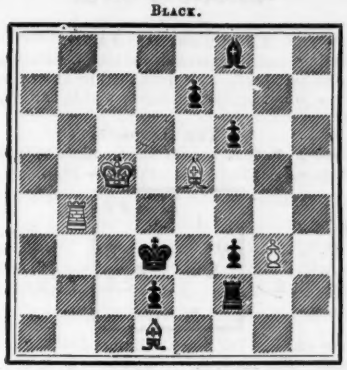

WHITE.

White to play and mate in three moves.

PROBLEM No. 118.

By F. J. LEE.

(Habitué of Purssell's.)

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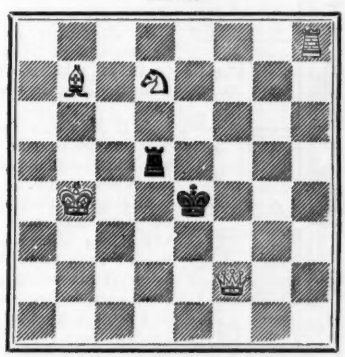


WHITE.

White to play and mate in two moves.

(A first attempt.)

SOLUTIONS.

PROBLEMS BY S. LOYD, p. 278.

I.*

1. B to Q5 (ch)
   - 1. K × KB — 2. Q to B6, mate
   - 1. K × QB — 2. Q to K2, mate
   - 1. K × P — 2. Q to B6, mate

II.

1. Q to K7
   - K to B4 — 2. P to B3 / K × P (*a*) — 3. Q to B5 / Mate
   - (*a*) if P × P — 3. Q to B7 / Mate
1. Q to K7
   - K × P — 2. Q × BP / K × P (*a*) — 3. Q to R8 / Mate
   - (*a*) if P to Kt5 — 3. Q to R4 / Mate
1. Q to K7
   - P to B4 — 2. P to B4 / P × P (*a*) — 3. Q to R4 / Mate
   - (*a*) if K × P — 3. Q × P / Mate
1. Q to K7
   - P × RP — 2. Q × BP / P to R5 — 3. Q to B3 / Mate
1. Q to K7
   - P × KP — 2. Q × KP(ch) / K × P — 3. Q to R3 / Mate

PROBLEM No. 116, BY H. W. SHERRARD.

1. R to K6 / K to Q4 — 2. R to B6 / K to Q5 — 3. K to K6 / K to K5 — 4. R to B4 / Mate

* This Problem is the only two-mover I remember to have seen which begins with a check, and yet is worth examining. It was for this reason I selected it.—R.P.

Our Whist Column.

By Five of Clubs.

AN AMUSING HAND.

THE following hand appeared in the *Westminster Papers* on September 1st, 1877. It is described by the editor as showing how "to induce your partner to throw up his cards with the game in his hands."

THE HANDS.

B { *Clubs*—K, 9, 6, 2. Hearts—A, 5, 2. | Diamonds—A, Q, 6, 5. Spades—10, 5. }

Y { *Clubs*—Q, 7, 5. Hearts—Q, 8, 4, 3. Spades—A, Q, Kn, 9. Diamonds—10, 4. }

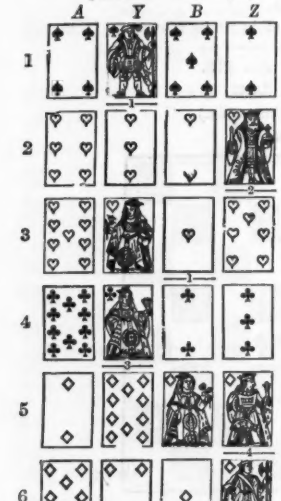
B *A-B*, 3.

Y *Y-Z*, 4. Z *Trump.* C. 4.

A Leads.

Z { 3, 4, 8—*Clubs* 7, K—Hearts 2, 3, 7—Spades 3, 7, 9, Kn, K—Diamds }

A { *Clubs*—A, Kn, 10. Hearts—Kn, 10, 9, 6. | Diamonds—8, 2. Spades—K, 8, 6, 4. }



NOTES AND INFERENCES.

1. *A* should have led his Heart Knave: Hearts are his best suit. *B* from his own hand and the fall of the cards infers that *A* has led from a long weak suit.

3. *B* infers that the winning Hearts are probably with *A*.

4. *A* makes an inexcusable finesse, and in trumps, led by his partner! *B* infers with confidence that the Ace lies with either *Y* or *Z*.

5. It is a fair inference from *Y*'s change of suit that he does not hold the trump Ace. But this is not yet certain.

6. *B* infers that *A* and *Y* have no more diamonds. *Y* certainly has none; therefore *Z*'s Knave cannot have been the highest of two left: it would therefore not have been led unless the highest of a sequence,—that is, unless (ten having been played) *Z* held the nine. Hence *A* can have no more.

7. *B*, very properly, forces his partner. It is now clear to him that *Z* holds the Ace of trumps.

9. At the end of this round *B* threw up his hand. It seemed clear from the play that besides the Ace of Spades, *Y-Z* must hold the Ace of trumps. It was therefore apparently idle to continue the contest.

10. *B*'s Diamond is called.

11. His smallest trump is called.

12, 13. *Y-Z* make two by cards, and win.

Obviously *A-B* would have won the game had not *A*'s preposterous play deceived *Z* utterly. But the game has another moral:—

Never throw up your cards while there is any possible chance of saving the game, even though that chance may be that your partner has played very badly. Even a good player might through mishap have played as *A* did,—either taking hold of the wrong card at trick 4, or overlooking the Club Ace in sorting. Both would indicate great carelessness, but sometimes even good players are careless.

ERRATUM.—In the game last week the King and Queen of Clubs (trumps) should change places.

THERE is a very fine set of bells in the Clock Tower of the Royal Courts of Justice, but, says a contemporary, they are so completely boxed in that only a muffled ghost of their fine tones can wriggle its way through the nearly closed louvres.

THE total number of coal mines of all kinds in operation in 1883 was 3,707, against 3,814 in the previous year. There was, therefore a decrease of 117 in the number of mines at work, concurrently with an increase of 7,237,350 tons in the quantity of coal produced.

THE total number of hands employed in the mines of the United Kingdom in 1883 was 514,933, against a total of 503,987 for 1882. This corresponds to a production of 346 tons per man in 1883, and and of 339 tons per man in 1882. It would appear, therefore, as if the workmen had generally done better average work in the former than in the latter year.

TELEPHONE companies still endeavour to meet the demand for underground wires by asserting that communication through such wires is impossible, except for two- or three-mile lengths, on account of mutual induction. The postal telegraph department is, however, using in their telephonic system underground wires upwards of fifteen miles in length.

IN the lead production of different countries Spain still holds the first place, the amount reaching some 120,000 tons in one year, or one-sixth more than America, which comes next on the list, while Germany follows with 90,000. Of Spain's total production some 67,000 tons are derived from one district, that of Linares, in which more than 800 mines are registered. Of this large number, however, only a comparatively small proportion are actually worked on a large scale, and there are only about fifty in which steam power is used. The total number of steam-engines employed is stated to be 130, nearly one-half of this number belonging to English companies; in fact, most of the mining machinery and pumping engines in all the mines are of English make.—*Engineer*.

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